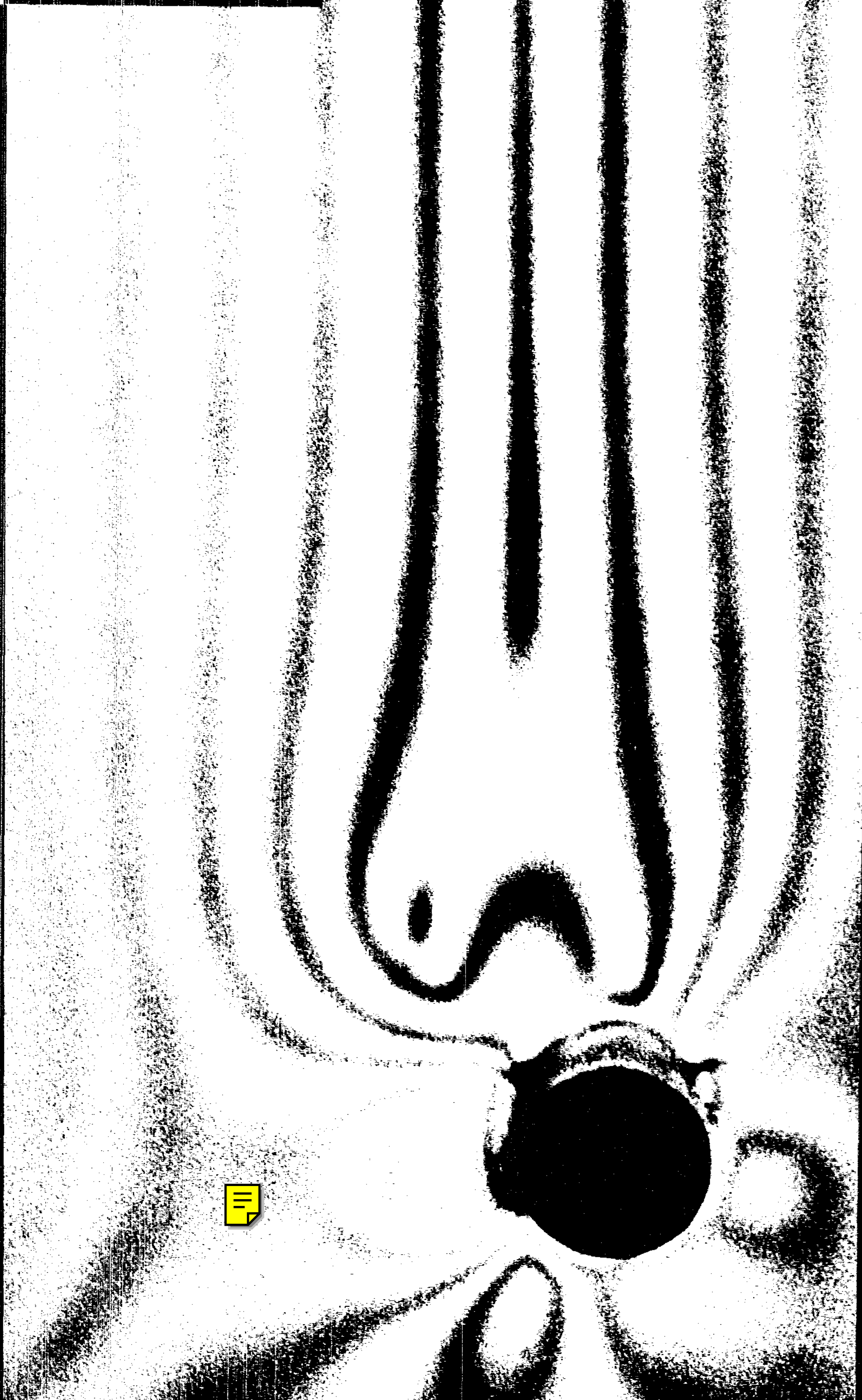
THE ATOM

Los Alamos Scientific Laboratory September 1972



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THE ATOM

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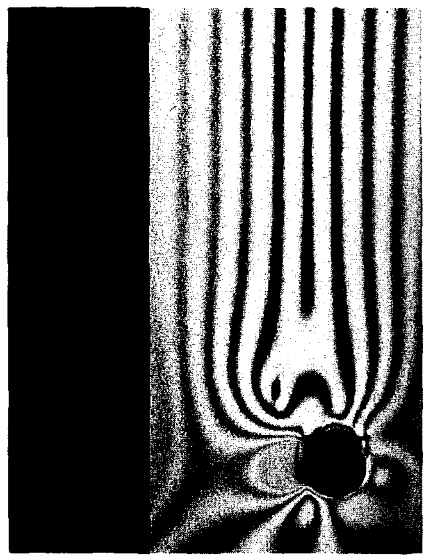

COVER:

Strains in a plastic calibration beam appear as fringes when illuminated with polarized light and viewed through appropriate filters. The process, known as photoelastic stress analysis, is one of several methods being used by Group WX-1 to help determine material strengths and proportions for the design of a new artillery shell. For more information, see the story which begins on page 10.

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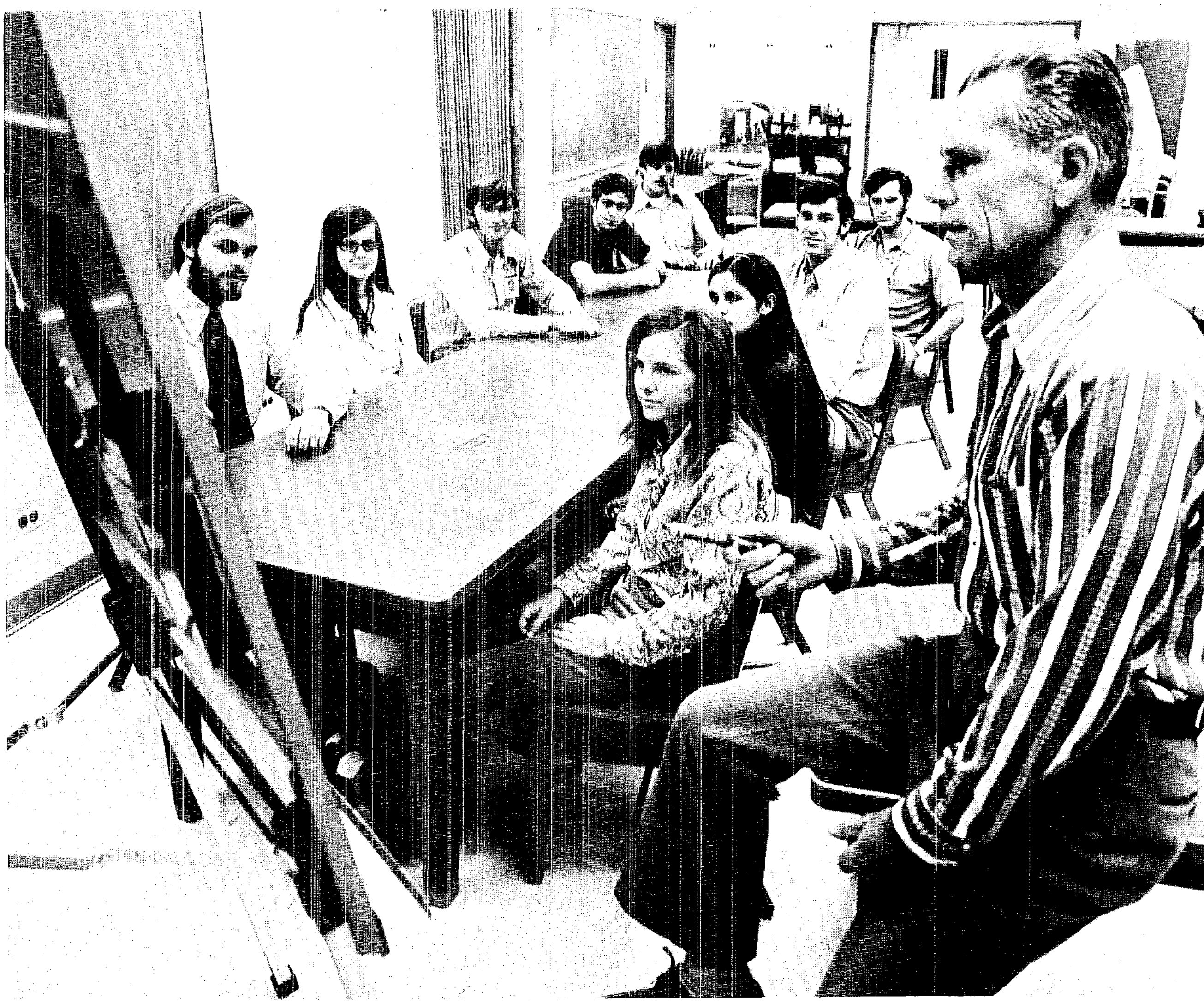

Ted Dunn, university relations coordinator for LASL, talks to the nine co-op students presently working at the Laboratory.

The Co-op Story

Every year a greater number of college graduates go first-time job hunting armed not only with a degree but *with a work history in their* chosen fields as well. This comes about as a result of the growing number of undergraduate cooperation programs worked out by employers and university and college officials.

The Los Alamos Scientific Laboratory first tried cooperative education on a limited scale in 1964 when two chemical engineering students from New Mexico State University were selected to work alternating six-month periods in Group CMB-8. The following year, four students from NMSU were accepted into the co-op program and this arrangement continued through the 1960's. The experiment proved so successful that the cooperative education program now involves

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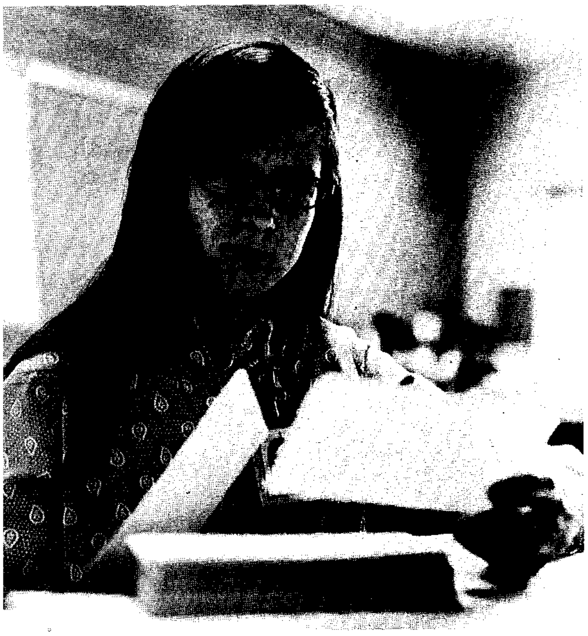
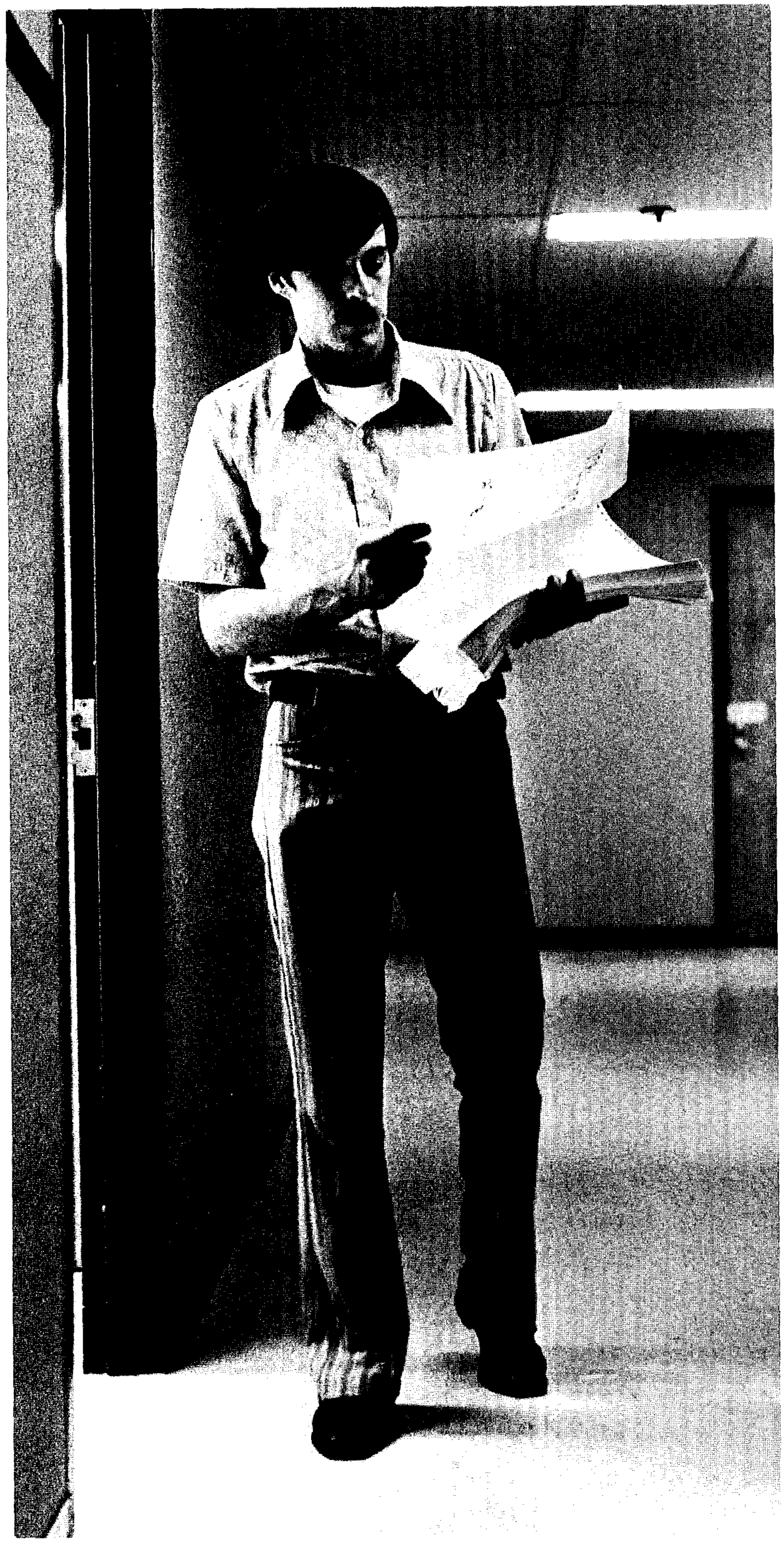


Miriam Moore, a senior computer science major at NMIMT, is working in Group T-1 as a computer programmer.



Jonathan Bourne, a sophomore at ENMU majoring in computer science, looks over computer listing. He is working in Group C-1.

18 students from five New Mexico universities.

This expansion stems from a meeting of Laboratory and New Mexico college and university officials at Los Alamos in 1971 to explore possible areas of mutual cooperation. The meeting was suggested by Laboratory Director Harold Agnew who believes the Laboratory can be of greater service to education. It was mutually agreed that the co-op program was a valuable educational tool and should be expanded. Agnew subsequently proposed that Atomic Energy Commission support be increased to allow the participation of up to 30 students in LASL's undergraduate program. H. Jack Blackwell, area manager of the AEC's Los Alamos Office authorized the increased participation and LASL and educational officials have been building toward the full complement of undergraduates ever since.

According to Ted Dunn, university relations coordinator for the Laboratory, the 30 authorized positions may be filled by the beginning of the next six-month work phase which begins in January.

In addition to emphasizing LASL's interest in education, there are benefits derived from the program which fan out in many directions. A co-op student can obtain invaluable practical experience in his field by the time he graduates. Such a work history is a valuable asset in that it helps the graduate avoid the sometimes necessary "stepping-stone" jobs which provide experience required to land a job of his choice. It helps students determine if they will be happy with their careers after graduation. If he comes to the Laboratory from NMSU he is offered one semester credit for a report on his co-op experience. New Mexico Highlands University offers two quarter credits for a similar report. To the universities and colleges, the cooperative education program means continued exposure of classroom situations to actual practical applications. Such exposure can be used for updating or changing the scope of courses to better meet the needs of the graduate who must compete for today's technical jobs. Since the co-op is assigned to "real," not "created," work situations, both the Laboratory and society benefit from the program.

To date the undergraduates assigned at the Laboratory have generally proven to be hard working and eager to apply what they have learned in the classroom. Upon return to the campus they traditionally exhibit greater confidence in their studies.

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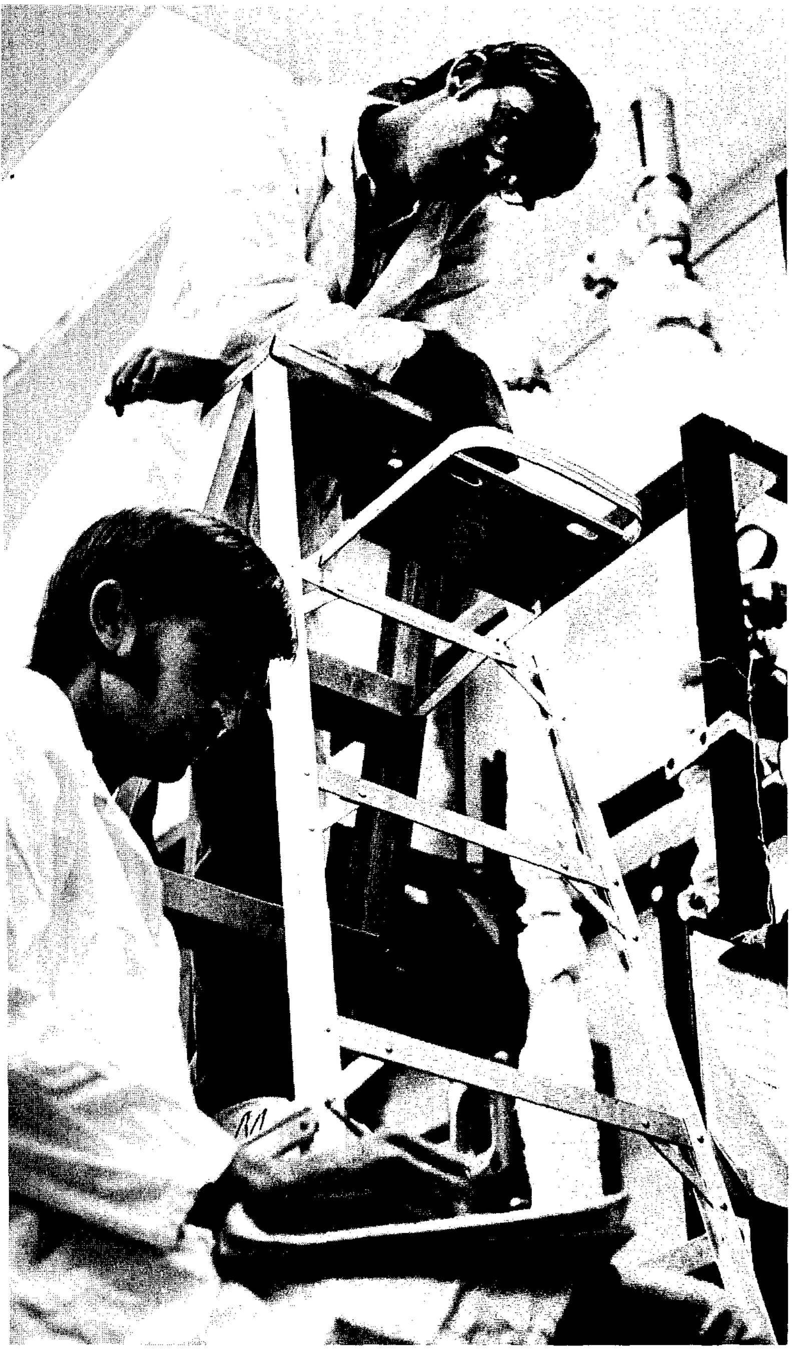
Above, Anna Marie Trujillo, a sophomore mathematics major at NMHU is working as a computer programmer in Group MP-6. Below, Michael Orrell, a junior mechanical engineer at UNM, and Henry (Lou) Horak, a senior mechanical engineer at ENMU, are both working in ENG-7. Orrell is currently doing design and drafting work in connection with isotopes production. Horak is doing strength-of-materials studies with relation to Project Sherwood.



Roger Chapman and W. David McNeese, sophomores at NMSU, both majoring in chemical engineering and both working in Group CMB-8, take data from a corrosion experiment on metals.

According to Dunn, the highest hurdles in the program are matching students with jobs and providing them housing. To participate in the program, a technical project must be of a nature that is compatible with the educational level of the student and its staff must be prepared to provide him with adequate supervision and guidance. Fortunately, some groups including CNC-11, ISD-4 and WX-3 are aware of CMB-8's favorable experience with co-ops and have surveyed their organizations to determine whether students can be involved. In these cases, members of the group provide Dunn's office with a description of the job, certification that it is real work and that a co-op will be provided with adequate supervision and guidance. Dunn forwards the job description to the various New Mexico colleges and universities whose cooperative education program directors propose candidates for the position. Many candidates are invited to Los Alamos for discussions with representatives of the groups where positions exist.

Participation of each university has so far been limited to allow representation from all of the institutions taking part in the program, and to provide for a variety of technical fields. This is because some institutions are better established than others in cooperative programs and are capable of literally filling all of the Laboratory's available co-op positions. In order that each institution has the opportunity to be represented, one school must necessarily be given preference over another where fields of study overlap. From New Mexico State University, undergraduate students taking part in the co-op program are generally chemical, mechanical or civil engineering majors; New Mexico Highlands University—biology, chemistry or mathematics; University of New Mexico—electrical or mechanical engineering; Eastern New Mexico University—library science or computer science; New Mexico Institute of Mining and Technology—computer science with technical applications.

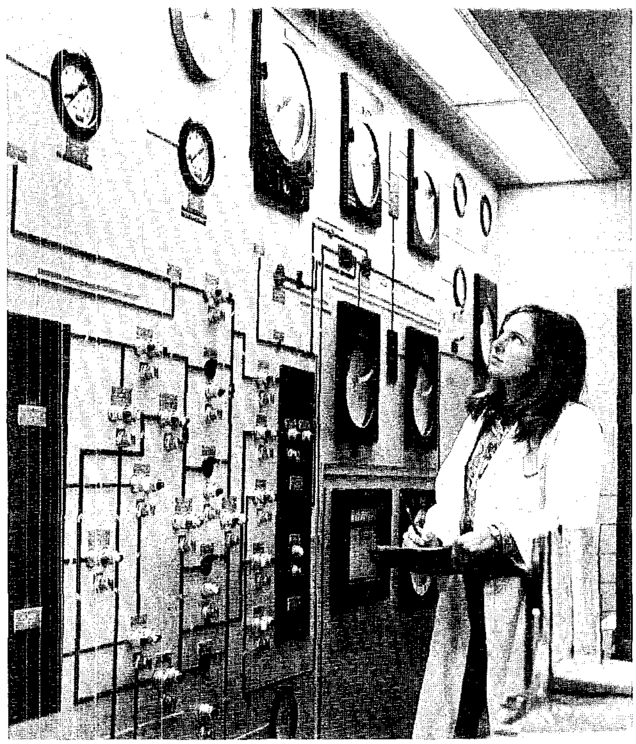
Students selected for the program alternate six-month work phases at LASL with equivalent periods of campus residency. Because of this, only half of the participating students work at the Laboratory at any one time. During the current work phase (July-December), there are nine students working at Los Alamos. These include four from NMSU: W. David McNeese and Roger Chapman, sophomores, both majoring in chemical engineering and both working in Group CMB-8; Donna Harkey, a junior chemical engineering major, working in Group H-7; and Henry (Lou) Horak, a senior mechanical engineering major in Group ENG-7; one student from UNM, Michael Orrell, a junior majoring in mechanical engineering who is working in Group ENG-7; one undergraduate from ENMU, Jonathan Bourne, a sophomore computer science major in Group C-1; two students from NMHU: Anna Marie Trujillo, a sophomore mathematics major in Group MP-6, and Victor Chavez, a junior biology major in Group H-4; and one undergraduate from NMIMT: Miriam Moore, a senior majoring in computer science and working in Group T-1. Of these Chapman and Chavez are on their second tour under the co-op program.

Wages paid the students were devised so as to provide them with a "bare-bones" living while working at the Laboratory. With proper money-management, Dunn said, the students can save enough to pay their college expenses during the next six months of campus residency. Freshmen co-ops are paid \$104 a week; sophomores, \$108; juniors, \$112; and seniors, \$117. Any undergraduate returning to LASL with the same class standing held during a previous workphase is eligible for a \$2 per week increase.

The co-op is not obligated to work for the Laboratory after graduation, nor is LASL or the AEC committed to employ him. Including the nine students now working at the Laboratory, 32 have participated in the cooperative education program. Seven have graduated and five are known to be employed in AEC laboratories or their industrial nuclear counterparts. While this is an indication that some will stay in the field in which they worked as co-op students, the numbers are far short of providing accurate statistics to show the migration of a co-op after he graduates. Statistical information such as this will be compiled as it becomes available and will be of considerable value to the tentatively planned Undergraduate Cooperative Program Committee. "I'm suggesting that we form such a committee," said Dunn, "so that we can look at our experience on the basis of evaluation reports on students submitted by members of groups where they work. Its membership would include Personnel Department representatives who process the co-ops' applications and members of the technical groups who have employed students under the program. The committee would evaluate the Laboratory's experience with the program and make recommendations for its future."

Victor Chavez, junior biology major at NMHU, works on a chemical separation process for a stable isotope project in Group H-4.

Donna Harkey, a junior at NMSU, majoring in chemical engineering, monitors the control console at the H-7 waste disposal plant.



Nuclear Furnace Successfully Tested

By Bill Richmond

The Nuclear Furnace, a small reactor designed at the Los Alamos Scientific Laboratory to test fuel elements and other core components for use in nuclear rocket propulsion, has been successfully tested at the Nuclear Rocket Development Station in Nevada.

During May, June and July a series of six tests was completed. They began with flow and criticality tests and concluded with two long-duration tests at the full power of 44 megawatts.

After some initial problems were corrected, the Nuclear Furnace-1 turned out to be an extremely successful test assembly, accumulating a total of 122.5 minutes at exit gas temperature at or above 3,500°F, including 108.8 minutes at the design temperature of approximately 4,000°F.

Many new design features incorporated in the reactor and the associated effluent cleanup system worked well during the entire test series. The full-power duration goal of 90 minutes was exceeded. The large amount of data accumulated on the operating characteristics of the effluent cleanup system is expected to be quite useful in designing larger systems for the testing of nuclear rocket engines.

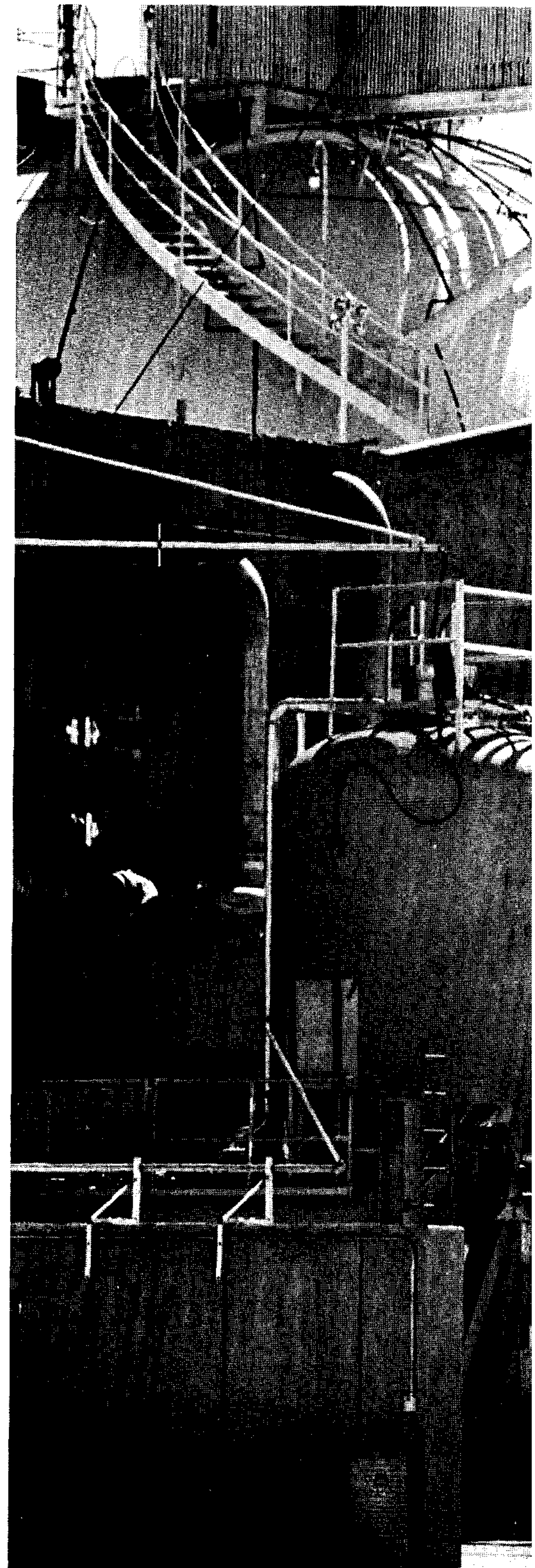
Scientists involved with the Rover project have investigated reactor designs covering a wide range of sizes. Tests have been conducted for the large size (Phoebus series), and the small size (Pewee). In the search for even smaller test reactors it became apparent that a very small water-moderated critical system could be constructed which would meet the requirements for testing full scale fuel elements.

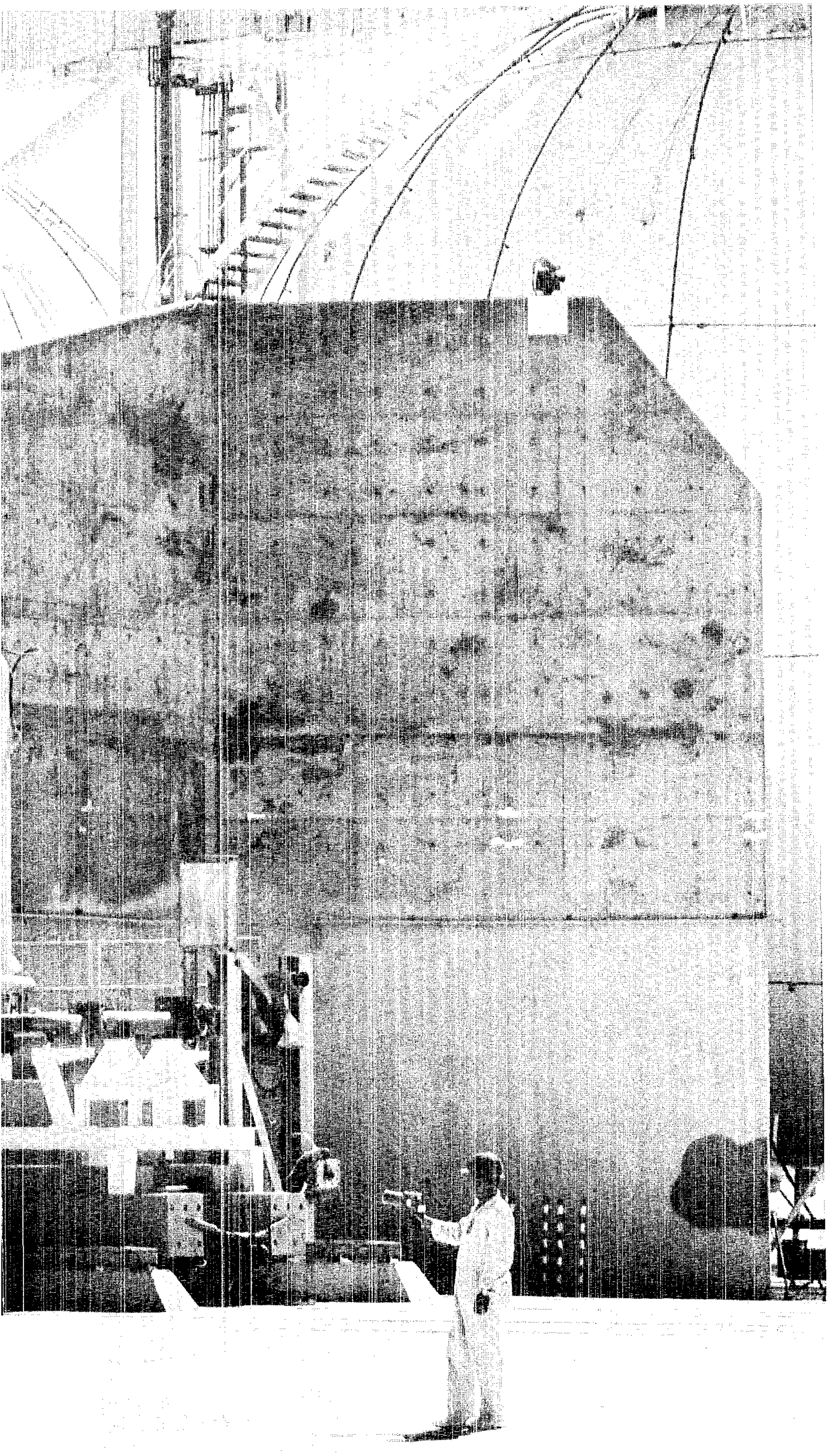
The Furnace—which uses existing hardware from the Phoebus and Pewee reactors—was the result. By utilizing hardware that had already been built, it was possible to hold the cost down and also use data that had been collected from prior tests.

All that has to be disposed of in the Furnace is the core—after postmortem checks are conducted on it. The rest of the hardware can be reused several times if desired.

The Furnace contains 49 fuel element cells located in a remotely insertable core tube assembly, which also provides the volume through which the water moderator flows. The permanent part of the assembly includes the beryllium reflector, the pressure vessel, and an injector. Gaseous hydrogen is used to cool the reflector and pressure vessel, and is then directed through the fuel elements and the injector assembly into the exhaust duct. Moderator water flows through and cools the core tube assembly.

After leaving the reactor, approximately one-half of the moderator water flow is directed into the injector, where it is sprayed into the hot hydrogen steam leaving the reactor, reducing the gas temperature to protect the duct. The mixture of steam and hydrogen is then ducted to the effluent cleanup system





A monitor checks radiation level at the Nuclear Rocket Development Station's Test Cell C where Nuclear Furnace-1, encased in grey, dome-shaped shield, was successfully tested.

where it is routed through various heat exchangers and separators, a drier, and a cryogenic charcoal trap. The dry, clean, gaseous hydrogen is then exhausted to the atmosphere through a flare stack. This is the first time a large scale effluent cleanup system with high hydrogen flow and temperature has been tested.

In Nuclear Furnace-1, 47 of the fuel element cells contained the newly developed, high performance uranium-carbide / zirconium-carbide-carbon composite elements. The remaining two cells contained clusters of small uranium-carbide/zirconium-carbide elements which are in a very early stage of development. Two of the 47 cells containing composites were insulated with an experimental porous zirconium-carbide insulator material. The remaining cells were insulated with conventional pyrographite.

The cryogenic charcoal trap in the effluent cleanup system was operated at different temperatures during each of the last four experimental plans to obtain design data on retention of the noble gases xenon and krypton. On EP-4, when the charcoal trap was operated at about minus 170°F, the retention of the noble gases was approximately 100 per cent within the first half of the trap.

A small amount of control rod motion observed during the test series was dominated by the effect of fission poison buildup and was therefore not a good measure of carbon loss from the fuel elements. Detailed information on fuel element corrosion and integrity will

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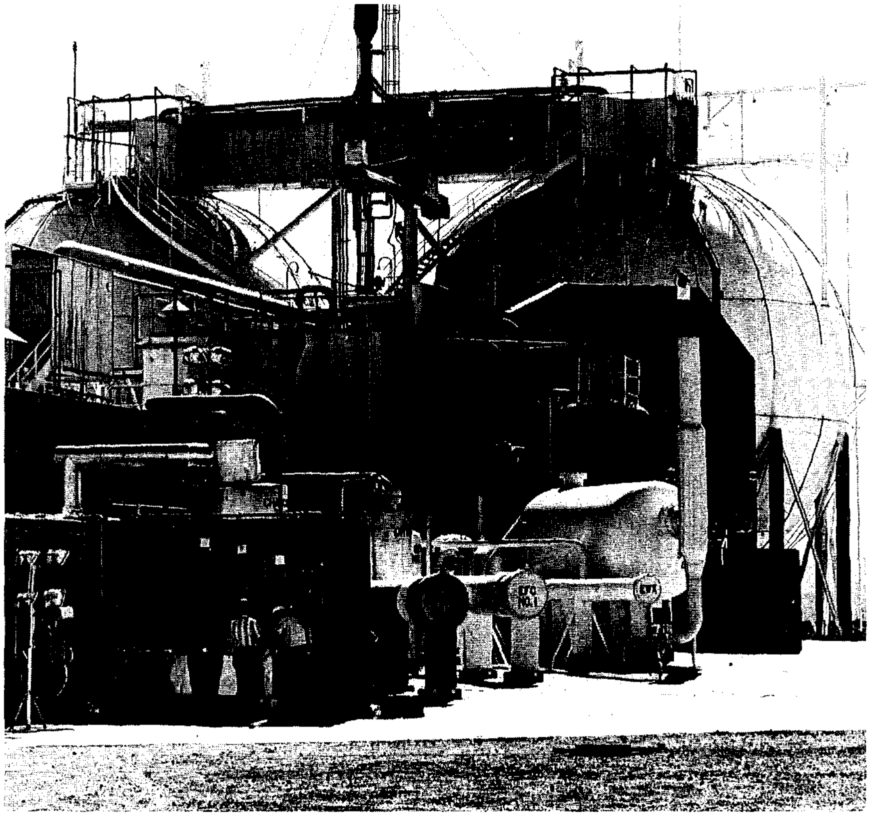


The furnace and its effluent cleanup system (foreground with letters EFC) are dwarfed by the large hydrogen dewars in background.

SUMMARY OF NUCLEAR FURNACE-1 TEST RESULTS
Reactor
—Demonstrated the capability and integrity of the water-moderated reactor design to achieve its performance goals and to operate with the fuel elements at design conditions of flow, power and temperature.
—Operated for 108 minutes at full power and temperature.
—Conducted four full power tests and five thermal cycles to significant temperatures.
—Provided first reactor test of composite and carbide fuel elements.
—Demonstrated reliability of fuel element exit gas thermocouple design at temperatures more than 4,000°F.
—Provided time-temperature history for each fuel element by individual fuel element exit gas temperature measurements.
Effluent Cleanup System
—Demonstrated capability of water injection cooling systems to reduce reactor exit gas temperature to be compatible with effluent cleanup system.
—Demonstrated the predicted overall reactor-cleanup system operation behavior and controllability.
—Demonstrated the capability of the effluent cleanup system to contain approximately 100 per cent of all fission products including the noble gases, xenon and krypton.
—Provided design information for scaling up to small nuclear rocket engine.

be obtained after disassembly of the reactor which is now in progress. The fuel elements will then be brought back to LASL for detailed examination.

The Furnace, along with its instrumentation and controls, was designed in N-Division. The fuel elements were developed by CMB- and N-Divisions and were fabricated by CMB-Division and the Shop Department. Nondestructive testing was provided by group M-1. The effluent cleanup system was designed by J-Division during the time it was responsible for testing LASL nuclear rocket reactors. Group CNC-11 provided assistance in measuring and evaluating the effectiveness of the cleanup system.

Field testing was conducted, to LASL requirements, by the Westinghouse Nuclear Rocket Test Organization, assisted by EG&G and Pan American Airways electronics and mechanical support. Overall management of the test was under the joint AEC/NASA Space Nuclear Propulsion Office's Nevada Extension.

The Test Program Manager for LASL was Richard Bohl of N-4 and the LASL manager of assembly/disassembly was Avery Bond of N-DOT. Numerous other members of N-Division also participated in the test operations.

Nuclear Furnace-2 is planned for testing during the summer of 1973 and will be operated at the higher temperatures (about 4,500°F) planned for the small nuclear rocket flight engine now in preliminary design at LASL.

Costa Cassapakis, right, and UNM Physics Professor Byron Dieterle, work on electronic system for forthcoming LAMPF Experiment 56.

Costa Finally Made It

For eight years Costa Cassapakis had a strong desire to do experimental physics at the Los Alamos Scientific Laboratory. He finally made it.

Cassapakis is a native of Greece. He came to the United States in 1963 and enrolled in classes at Eastern New Mexico University. "I wasn't satisfied with the higher education system in Greece at the time," said Cassapakis. "I wanted to travel and I had read so much about the western part of the United States."

In 1964 Cassapakis and his roommate were visitors at the home of Roy Reider, H-3 group leader. "I was impressed with the work being done here and with the location. The countryside was breathtaking," he said.

"Although I wanted to work here, I'm a foreign national and I didn't think I could. But, when I was a senior, I took a trip up here with some other students and we toured some of the Laboratory's facilities. I saw that there was work, other than defense, going on and I thought maybe I could work in some unclassified area. It was my first time in a scientific laboratory and a town full of scientists and engineers.

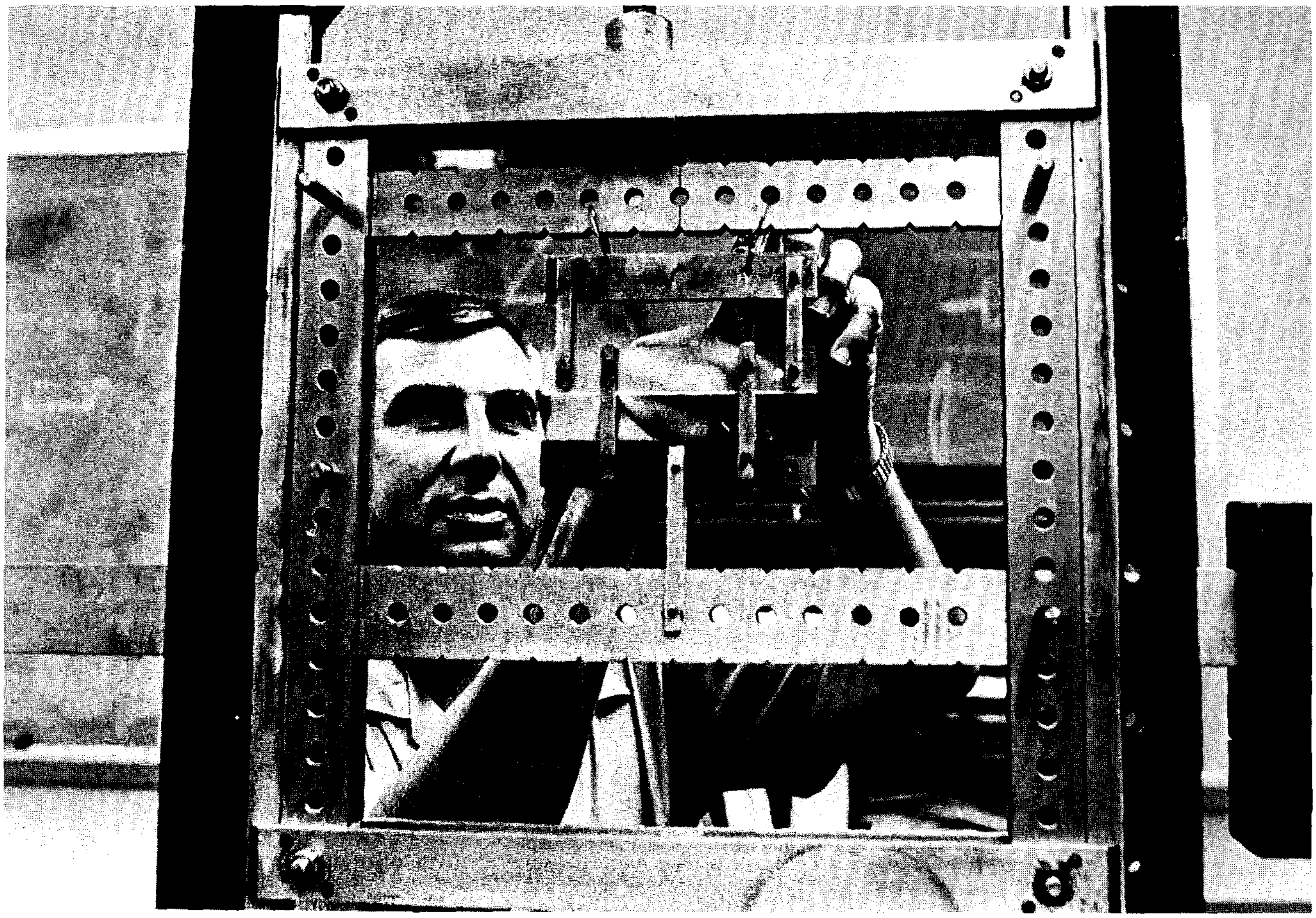
"I took the bachelor's degree in science and math at Eastern and then transferred to the University of New Mexico. I had two years' association with Chris Leavitt, a professor at the University who was doing some work with LASL people. A year ago I became acquainted with two new UNM professors—Byron Dieterle and David Wolfe. They, Leavitt, Professor Howard Bryant, Graduate Student Stan Cohen and I formed a particle physics group at the University.

"The group collaborated with Jim Simmons, P-DOR at LASL, and scientists at Texas A&M. This collaboration resulted in the proposal of 'Experiment 56' which is approved for beam time when LAMPF becomes operational." Experiment 56 is designed to provide a better understanding of the nature of nucleon-nucleon forces. Cassapakis, a graduate student at UNM, will base his dissertation on the LAMPF experiment.

"We are now preparing for the experiment. I will be in Los Alamos for one and a half to two years. Cohen will also be here full time. Dieterle and Wolfe are here for the summer under an AWU (Associated Western Universities) grant and will later divide their time between their UNM teaching duties and the experiment."

From the battlefield to the laboratory

Stress Analysis Has Come a Long Way



Robert Groff, who does the photoelastic analysis work for the artillery shell project, "loads" a plastic calibration beam which will later be viewed through the filters of a polariscope.

Why was the stone axe succeeded by the bronze sword? Why did the bronze sword give way to one of iron, and iron to one of steel? The answer is that the successor in each case was more capable of withstanding the forces of battle.

Unwittingly, our ancestors who used these weapons might be said to be among the world's first stress analysts. Fortunately, however, the science has progressed to the point where strength-of-materials tests no longer have to be done on the battlefield; there are now more sophisticated methods for matching and proportioning materials with the loads they must be built to withstand.

A good example of the problems stress analysts face and the methods used to resolve them concerns Group WX-1 at the Los Alamos Scientific Laboratory which is partially responsible for the design of a new artillery shell for the U.S. Army. WX-1 is an engineering group whose members work on the design of nuclear components, and oversee fabrication and evaluation of test material for weapons.

WX-1's portion of the project, led by Neil Davis, alternate group leader, includes the design of the shell case. Other parts of the project are divided among many other groups at the Laboratory.

The basic problem is that conventional and nuclear components are very different and mixing the two is a difficult assignment at best. Aside from designing a workable nuclear system that will fit the lines of a conventional shell, component materials must be proportioned and put together in such a fashion that they will withstand the loads to which an artillery shell is subjected.

In part, these loads are similar to those a person feels when riding in an automobile. When the automobile is accelerated, a person is pressed against the back of the seat. Actually his weight is multiplied by acceleration and absorbed by the springs in the seat. This force, called "setback," is followed by "rebound," when the desired speed is reached. At this point the person's accelerated weight returns to normal and the compressed seat springs rebound, pushing the person slightly forward.

Setback and rebound, as they apply to an artillery shell, are many times more violent. Acceleration occurs in a fraction of a second to speeds of more than 1,000 feet per second. During setback, the weight of shell components is multiplied thousands of times by their resistance to acceleration. Those weighing pounds in a state of rest suddenly weigh tons, all pushing toward the base of the shell. The elastic properties inherent in materials absorb this increased weight just as do the seat springs in an automobile. After peak acceleration is reached, these elastic properties cause component materials to rebound, pushing toward the front of the shell. Components of inadequate strength would fall apart un-

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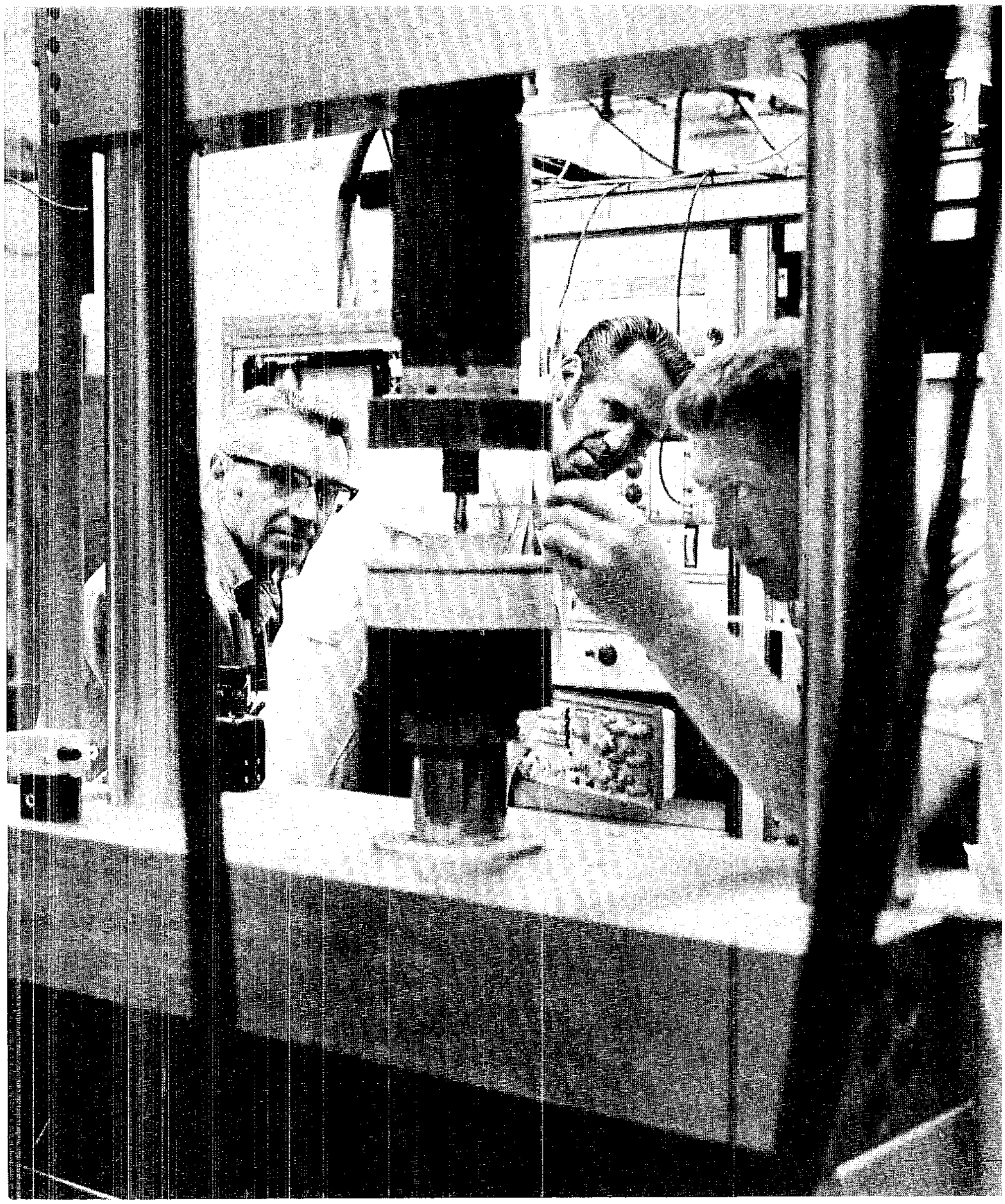

Various material samples are tested under pressure of a 1,200,000-pound press. Paul Schell, right, centers a sample between the jaws of the press. At left is Paul Dugan. Operating the console is Lloyd Ulery.

der such dynamic loads. Other stresses are torsional, which place twisting forces on components, and centrifugal which tends to distort or throw out components.

WX-1 stress analysts are currently conducting laboratory tests to help define materials and configurations of components for the shell case that will meet system requirements, and are working closely with other Laboratory groups that are responsible for other projectile components.

In these tests stresses and strains are simulated. There are two basic types of stresses regardless of what loads are applied. One is normal stress which is an expression of a material being either compressed or stretched. The other is shear stress, an expression of one part sliding past another. Normal and shear stresses usually exist together. Strain, the deformation, or change in dimension, is proportional to stress. The ability of a material to withstand a given amount of load is dependent not only upon the strength of the material, but also how it is proportioned or shaped. Simulated tests in the laboratory are designed to show how parts should be changed to improve their structural performance and, in this way, are an essential aid to component design.

While rough calculations and handbook equations help point the way toward likely materials, there are basically five complementary methods used to arrive at the detailed analysis required. All—static testing, strain gaging, stress coating, computer programming and photoelastic analysis—are being used by WX-1 on the projectile project.

Rarely can complete confidence

Dick Husted applies strain gages to a component. When the piece is subjected to loads, electric signals from the gages are a measure of strain.

Ulery and Husted check stress coating on a component for cracks which would indicate highly stressed areas.

be placed in stress values obtained through rough calculations or handbook equations. Static testing, a method of measuring stress under slowly applied loads, does not directly apply to the dynamic problems of an artillery shell, although it is being used to make some comparative studies.

The best known experimental method of analysis is with strain gages, small devices placed at critical locations on a component to convert changes in dimension to an electric signal which is used as a measure of strain. This is complemented by stress coating, the application of a brittle coating on a component. When loaded, cracks in the coating are indications of highly stressed areas and indicate where strain gages would yield the most useful information. Although precise, these methods indicate stresses only at specific locations.

Computer programming is a complementary method which provides an overall picture of a stressed com-

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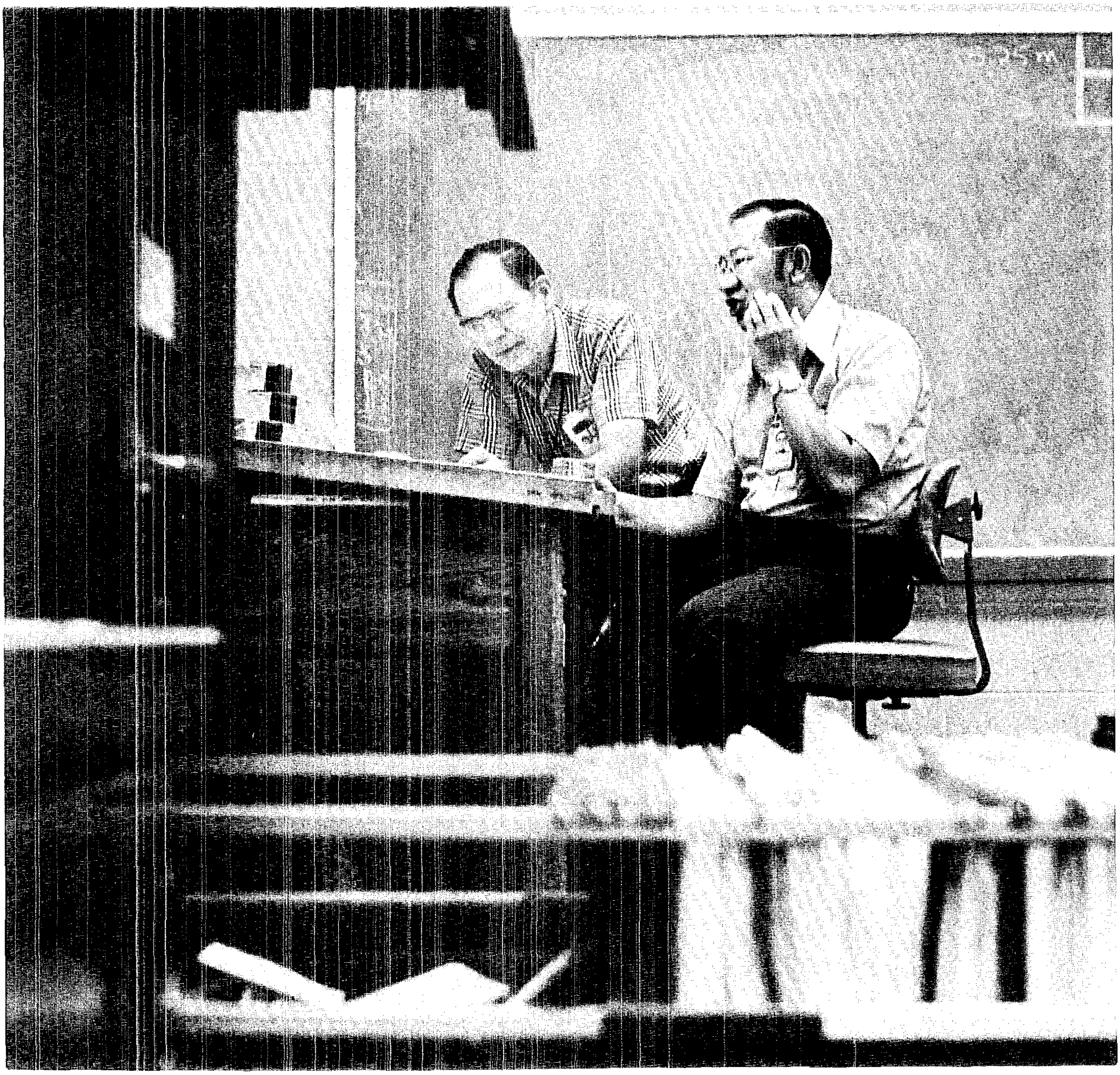
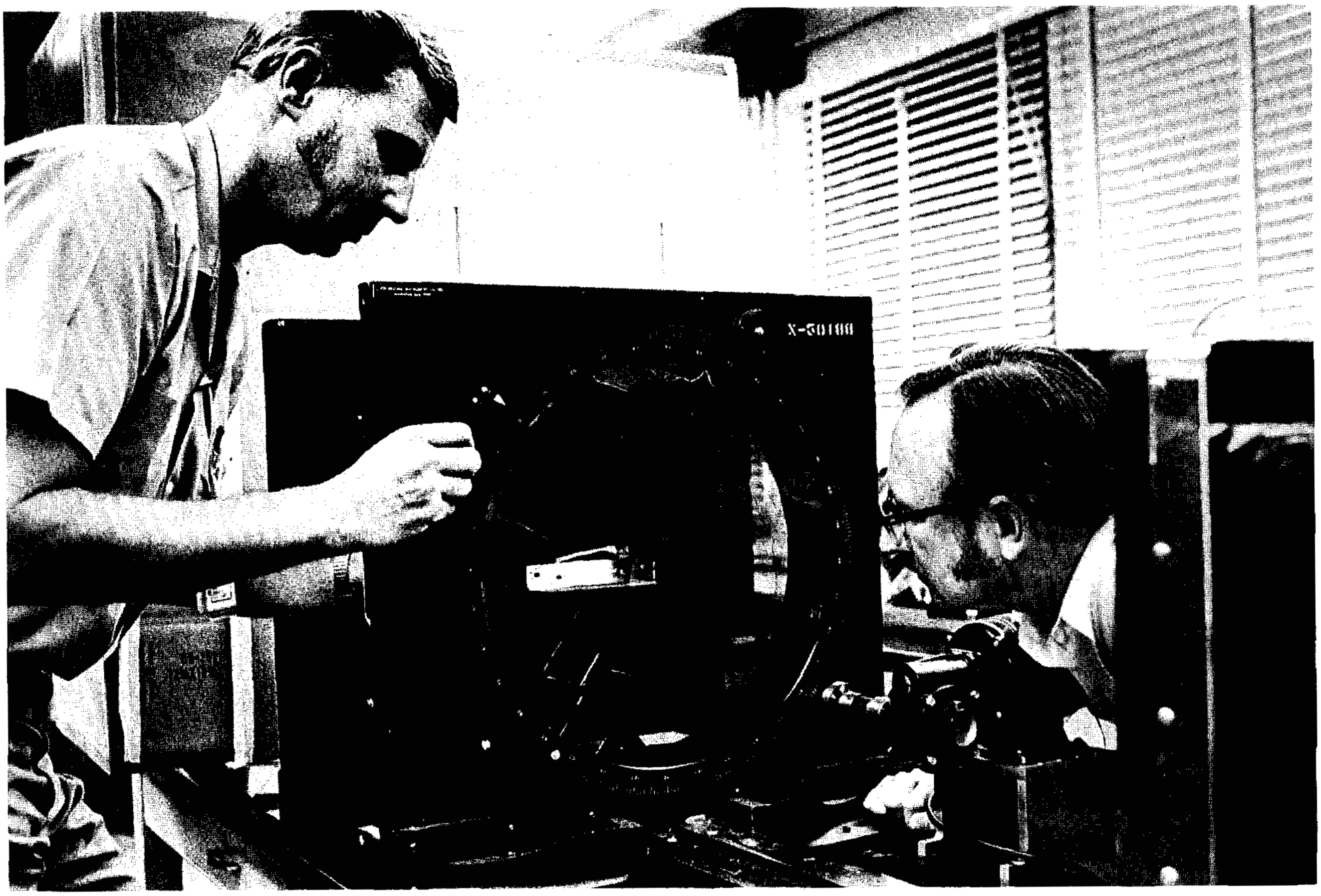
William Clouser and Harry Luke discuss results of computer stress analysis on a shell component.





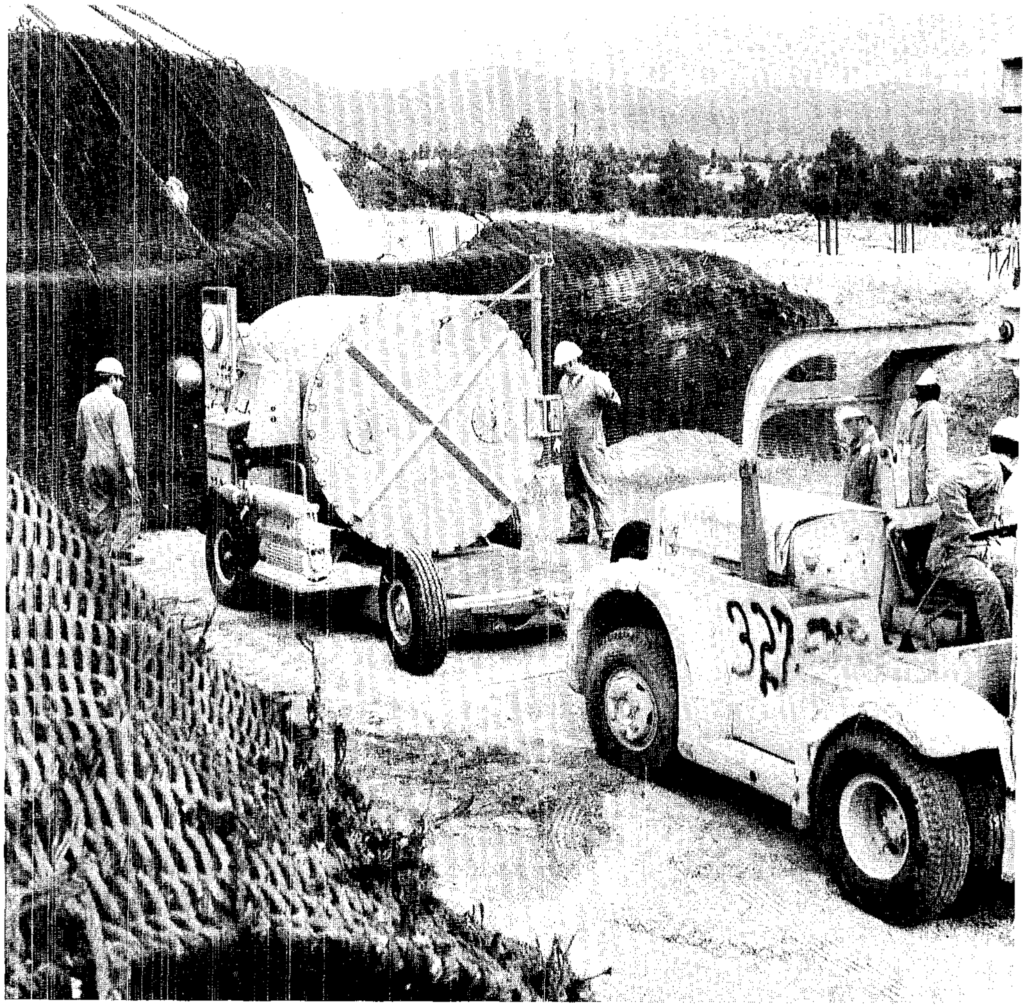
Groff and alternate group leader Neil Davis observe strain fringes in a plastic calibration beam and component "slice" through a filter on one of the WX-1 polariscopes.

ponent. Under the direction of Harry Luke, computer calculations are made to locate highly stressed regions in complex components and aid in properly placing strain gages. In addition, they speed the interpretation of laboratory results in complicated applications.

Photoelastic stress analysis has been slow to reach the state of acceptance of other methods, although in recent years, technological advances have made the process more allied to other analytical techniques. Polariscopes used in making photoelastic measurements were added to WX-1's arsenal of analytical tools only since the artillery shell project began. Photoelastic analysis, done by Robert Groff, is a method whereby components are duplicated in transparent plastic. Loads are applied to these plastic models and illuminated with polarized light. Strains become visible as colored fringes when viewed through appropriate filters and stress values are extrapolated from these. Like computer analysis, the photoelastic method complements strain gaging by showing overall stress patterns.

As a result of using these techniques and the close ties with other LASL groups working on the project, a shell meeting Army requirements will be designed and a prototype will be built. Proof testing will consist of an actual firing test conducted in conjunction with Sandia Laboratories on the government reservation near Tonopah, Nev. In this test, Sandia's telemetry systems will monitor the stresses placed on shell components during flight. The projectile will be rigged with a parachute so that it will be spared damage through impact. It will then be recovered and returned to Los Alamos where components will undergo detailed dimensional inspections by appropriate groups to verify integrity of the design.

Group M-2 personnel position the trailer-mounted, three-foot confinement vessel at PHERMEX.



Spinoff from LASL Confinement Vessels

There is no fireball, no dust or smoke, and no damage to nearby structures, and the sound is reduced to that produced by rapping a metal pipe with a hammer. Everything familiar about an explosion is absent, and yet there is an explosion.

The reason is that the detonations are confined in a steel vessel. Although developed at the Los Alamos Scientific Laboratory for use in physics experiments involving high explosives, the vessels are destined to serve another purpose. A modified version is being developed by Group M-2 for the U.S. Army's Picatinny Arsenal.

The project is being carried out through an agreement between the Atomic Energy Commission and the U.S. Army Munitions Command, Picatinny Arsenal, with local arrangements made through the Laboratory's Special Projects Office.

The objective of the project is to design, test and provide the Army with an experimental, mobile bomb-disposal unit. According to Roger Taylor, M-2 project engineer, the unit will combine features of two vessel systems used for several years at the Laboratory along with some straightforward design changes.

Confinement vessels are used by M-2 in conjunction with the powerful electron accelerator PHERMEX to flash radiograph explosive events. They were suggested for PHERMEX applications by Douglas Venable, alternate M-Division leader, when he was leader of the former Group GMX-11, and were developed by his engineering section. Since mid-1966 they have been used to confine more than 200 explosions in studies of the behavior of explosives and their effects on metals.

The flash-radiography process is much the same as that used in hospitals to radiograph organs of the human body. X radiation, rather than visible light, is used to produce a photograph—a shadow image of the variations in transparency of materials to radiation. PHERMEX, however, is much larger, more elaborate and powerful than hospital x-ray machines, and it produces much shorter bursts of radiation in order to stop the motion of an explosion. From this phenomenon the term "flash" radiography is derived. PHERMEX pulses a beam of electrons as short as one-tenth of one million of a second in duration. The beam's interaction with a tungsten target produces x rays. Some of these x rays pass through a confinement vessel and impinge on film sheets. By carefully synchronizing the beam pulse with a detonation, the result is a stopped-motion, flash radiograph of an explosion.

When used in physics experiments the vessels are placed inside steel jackets as an additional pro-

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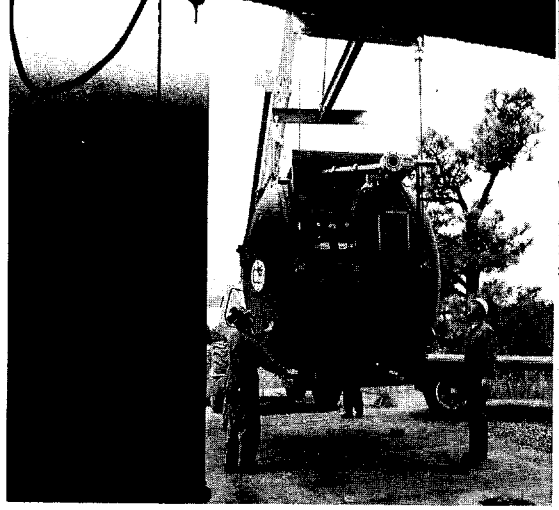
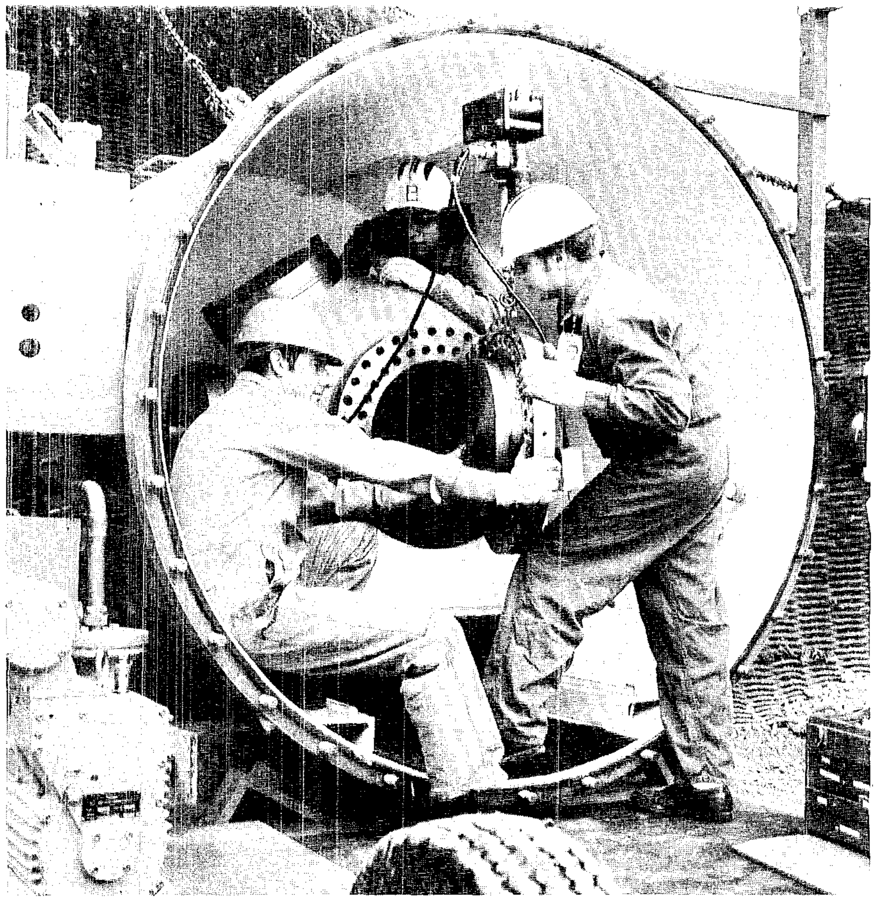
Members of M-2 prepare to load a six-foot vessel and steel jacket onto trailer at left. A wall of the building, right, moves away on wheels for the convenience of crane loading.



When the wall of the building was moved away, the jacket-vessel package was moved through the opening with pry bars. Steadying the confinement system are Kenneth Spicochi and Guy Eden.

Spicochi, Rodgers and Cushing remove the door from the loading port on a three-foot confinement vessel. The door is secured to the vessel by numerous bolts which fit in the holes in the face of the door and around the port.



Roger London gives the crane operator, Barney Cushing, the "lift" signal. At left is Larry Rodgers.

tective measure. They are moved in and out of the jackets on tracks.

The vessels have one-inch-thick walls and either three or four ports which are closed by steel doors secured to the vessel with numerous bolts. One port is used for loading an explosive. In its door are several electrical feedthroughs for a detonator and other instrumentation used to monitor an experiment. Another of the ports is used to evacuate the vessel. The vacuum eliminates the strong air shock produced by an explosion and permits about twice the amount of explosives to be detonated than would be allowable if the vessel were not evacuated. In addition, the vessels are sometimes filled wth vermiculite or perlite, insulating materials, which absorb some of the energy of explosions. A third port is for cleaning the chamber. Some vessels have a fourth port for more efficient entry of the beam of radiation.

The confinement vessels currently used are of two sizes. One, three feet in diameter, is used to confine six to eight pounds of either military or commercial explosives. Accessory equipment, including steel jacket, vacuum pump, instrumentation and hoist for door emplacement and removal, is permanently mounted on a four-wheeled trailer. The other vessel, six feet in diameter, will completely confine 22 to 25 pounds of explosives, but it is not as mobile as its three-foot counterpart. The building in which it is mated with its steel jacket has been engineered so that one of its walls moves away on wheels and a portion of the roof can be removed by a crane. A crane is then used to load the six-foot vessel and its jacket, as a single package, onto a four-wheeled trailer and to unload and align the system at PHERMEX. The vacuum pump and controls for this system also require crane handling and a trailer for transport.

The six-foot vessel will be pro-

continued on next page

Eden and London examine the loading port of a vessel built for proof-testing various rapid port closure schemes.

Benjamin (Buck) Rogers and Roger Taylor inspect a door that is operated with a hydraulic system. Rogers and Taylor constituted Venable's engineering section and were instrumental in designing the confinement vessels for Group M-2, then known as GMX-11.

vided to the Army. Instead of three or four ports, however, it will have two—one for vacuum lines to evacuate the chamber and the other for loading an explosive. Instead of a 20-inch loading port, common to LASL vessels, it will be 36 inches. Its door will have electrical feedthroughs for detonators, but will have to have a more rapid means of closing. Various schemes for rapid closure, including hydraulic systems, are being designed and tested for this purpose. Instead of a steel jacket, the vessel will be wrapped in a woven steel-cable mat. Like the Laboratory's three-foot vessel, the Army vessel will be permanently mounted on a four-wheeled trailer along with vacuum pump and hoist, an electrical power supply and a shielded enclosure for personnel operating the bomb disposal unit.

A vessel has been built for proof-testing various "quick" port closures. Final testing will be a destruction test to determine the vessel's upper limitations. The test will begin with 20 pounds of military explosives and will be increased in five-pound increments until the vessel fails.

Upon completion of the destruction test, M-2 will build a complete mobile test unit. Before turning it over to the Army, members of M-2 will field test the unit by confining a 20-pound explosive.

short subjects

Donelle Hawthorne, E-3, has been awarded life membership in the Telephone Pioneers of America, a community service organization with 359,000 members of which there are 1,247 in New Mexico.

Requirement for membership is at least 21 years in the communications industry. Mrs. Hawthorne has been in the communications field since 1937. She worked for Mountain Bell until 1946 when she joined Sandia Laboratories. In 1948 she was employed by the AEC's Los Alamos Area Office. She joined the Laboratory in 1966.

Homer Milford, H-1, a Laboratory employee since 1948, has retired. He and his wife, Winnifred, will continue to live in the Espanola Valley.

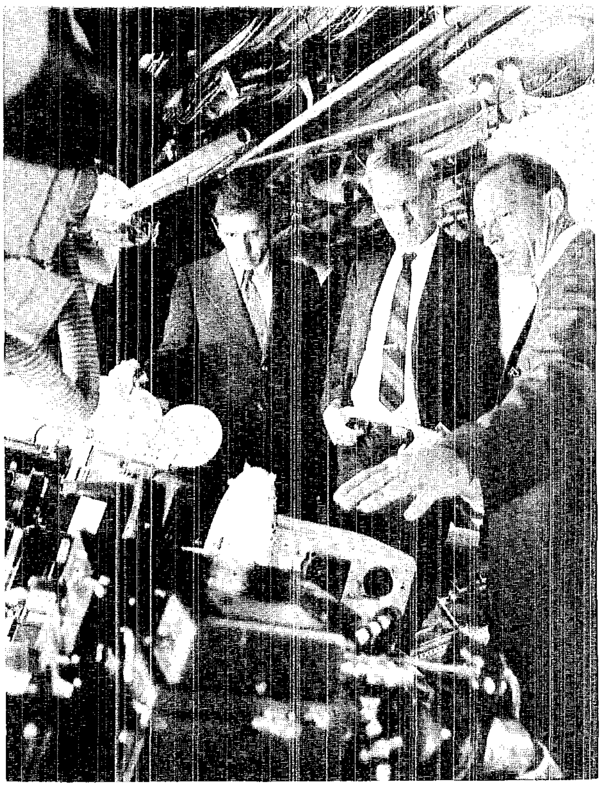
John Hockett, WX-5, recently visited facilities of the Canadian Department of Mines, Energy and Resources in connection with a new cam plastometer he designed and built for use at LASL and that has been adopted for use by the Canadian organization.

Hockett was invited to the Ottawa, Ontario facilities to consult with officials on construction and operating problems of the Canadian instrument and to present the seminar, "Compression Testing with the LASL Cam Plastometer."

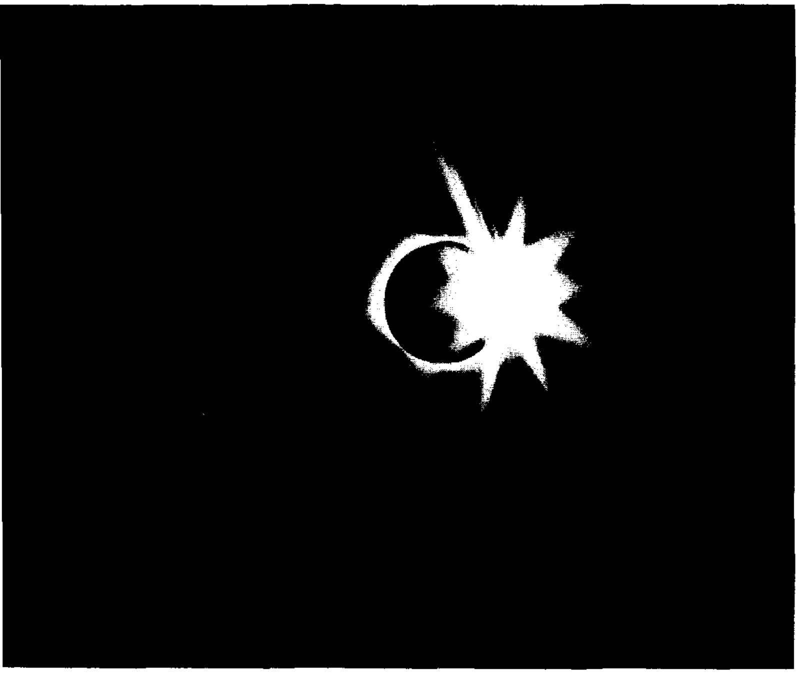
Eddie Roybal, SP-4, died July 6. Roybal was employed by the Supply and Property Department since 1952. He is survived by a daughter, Sophie.

Hazel Son, who recently retired from the Laboratory and moved to Graham, Texas, died while visiting friends in Los Alamos.

Clarence Brown, E-2, a Laboratory employee since 1943, died August 15 at the Los Alamos Medical Center. He is survived by his wife Zelda, and a son, Tracy.



Navy Captain R. E. Peterson, left, of the Chief of Naval Operations Office, and AEC Chairman James Schlesinger, center, listen to Bill Roach, J-10, describe the operation of a camera-tracking bench aboard an AEC/Air Force NC 135 flying laboratory. Don Kerr, J-10 group leader, and LASL Director Harold Agnew headed a group of Los Alamos, Sandia Laboratories, General Dynamics and EG&G people who flew on the aircraft to Andrews Air Force Base near Washington, D.C., to conduct two days of aircraft briefings and tours. Representative Chet Holifield and Representative Craig Hosmer of the Joint Committee on Atomic Energy attended the briefings along with more than 100 other high level representatives of various government organizations.



Bob Brownlee, J-9 group leader and veteran eclipse observer, photographed the end of totality for the July 10, 1972, solar eclipse and produced this striking picture of the "Diamond Ring" caused by the first rays of the sun shining through the valleys of the moon. Brownlee, who headed the coronal camera team for the 1966 eclipse, served as fill-in documentary photographer for this year's eclipse. A series of Brownlee's photographs were widely circulated by the Associated Press.

Progress In Sun Missions

By Bill Regan

An affair which began when man first warmed his primitive back in the rays from earth's great sun and dimly wondered "why" or "how" continues today at the Los Alamos Scientific Laboratory.

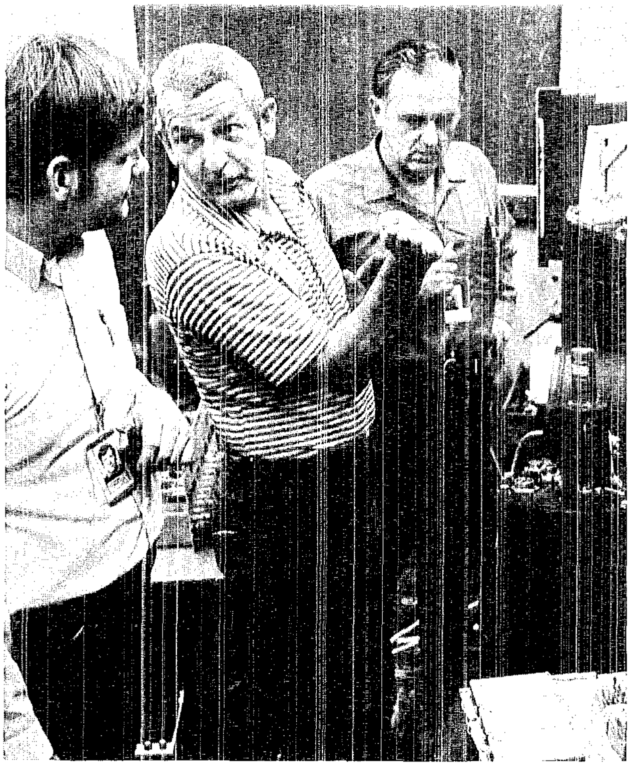
The quest for knowledge and understanding of the blazing center of our solar system is an endless one of ever increasing importance. For with the advent of the age of science and space, man first realized that his planet sails in a turbulent solar wind which constantly pushes and distorts our magnetosphere; is constantly bombarded with unseen particles which frequently have great influence on communications and weather; and that disturbances on the sun are a proper concern of earthlings for reasons other than curiosity.

Astronomers have studied the sun in various ways, in many cases repeating the same experiment year after year. Little bits of information are added one on top of the other to better understand the complicated processes of the center of our solar system. The basic concepts of solar investigation may remain constant, but improved technology permits acquisition of more or better data. In some cases, old data can be interpreted in a different way.

Since 1965, LASL solar eclipse investigations have been airborne on a NC 135 jet laboratory or lofted many miles above the earth aboard small sounding rockets. LASL accomplishments in this period have been significant. Equipment has become more reliable and automated. Stabilized platforms and photo tracking units which allow optical experiments to record finer detail over long exposure times have in themselves become the subject of experiments to develop better and more reliable units for each successive eclipse.

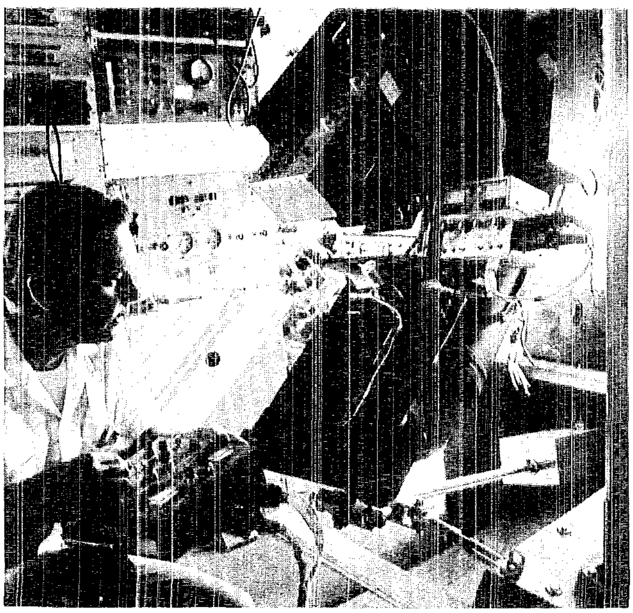
Two major experiments—the coronal camera and the Rube Goldberg—have contributed important information to further assist in better understanding of the solar magnetic field, motions, temperatures and heating mechanisms, and the origin of the solar wind. Both experiments were first flown in 1965 and, with improvements and modifications in equipment, have been repeated in 1966, 1970 and 1972. A third major investigation in the infrared region of the solar spectrum made its debut in 1970.

A new (from the standpoint of equipment) coronal-camera experiment was fielded by



Brook Sandford, Karl Theobald and Henry Horak, all J-10, discuss the payload for the rocket-borne experiment to measure zodiacal light during a solar eclipse.

Don Liebenberg, P-8, alternate scientific coordinator for SEX V, practices controlling the motions of the Rube Goldberg experiment.



Charles Keller, J-15. His photographs, taken through polaroid filters, show that the polarization of the outer corona is substantially different from that of commonly accepted models. The models predicted that per cent of polarization continued to decrease going out from the solar disk. Instead it was found that a minimum was reached at about seven solar radii with a marked increase to about 20 per cent at larger coronal distances. One coronal streamer was photographed out to 13 solar radii, one of the most distant ever recorded.

Photographs taken through polarizers are useful because they can be compared to separate the true coronal light which "is" polarized from the light scattered by interplanetary dust and the atmosphere which "is not" appreciably polarized.

Keller's data agreed with that reported by only one other observer, T. J. Pepin, an airborne investigator on the NASA Convair 990 aircraft in 1966. Now analysis is underway on 1966 coronal photographs taken by Bob Brownlee, J-9, and Tom Scolman, J-DO, to see if there is additional confirmation for the 1966 Pepin and 1970 Keller results. It is believed that a few of the frames taken in the first coronal camera experiment by Sid Stone, J-10, in 1965 may also be useful. Data reduction for the 1972 results is just beginning.

This data cannot be confirmed by ground observations because scattered light in the earth's atmosphere makes it impossible for ground-based experiments to record the corona in white light beyond about five solar radii. High flying jet observatories operate above 80 per cent of the atmosphere and are able to make measurements impossible to perform on the earth's surface.

A good example of this capability is found in an infrared spectrometer experiment first performed by Ken Olsen and Charles Anderson, both J-9, in 1970 and repeated this year. The 1970 observations reported on nine infrared emission lines in the active lower coronal region never before seen. It is expected that the 1972 version of this experiment performed even better. Increased sensitivity in the system and use of a calcium-fluoride window increased the range of emissions in the infrared which are detectable. Computer reduction of infrared data will require several months work.

The largest and probably the most complicated system aboard the aircraft in 1965 was the Rube Goldberg. It was named for its obvious resem-

continued on page 22

Infrared spectrometer team members Dave Yates, E-1, Ken Olsen and Charles Anderson, both J-9, practice experimental routines before the eclipse mission.

blance to the zany, complicated gadgetry cartooned by the artist of the same name. This monster of a contraption which has since proved to be a workhorse for eclipse studies had its beginning on the ground with the July 20, 1963, eclipse over the Northwest Territories of Canada. A Fabry-Perot interferometer was borrowed from the laboratory by two cryogenists from what was then CMF-9. The pair, Don Liebenberg and Ken Williamson, took vacation, traveled 7,000 miles roundtrip at their own expense and attempted to measure emission intensities of highly-ionized iron atoms, a way of determining temperatures in the corona. Although these observers, for what became known as LASL SEX I (Solar Eclipse eXpedition), saw the eclipse visually, data taking was essentially wiped out by a high layer of thin cirrus clouds. However, a jet aircraft of the Douglas-National Geographic expedition met totality above the clouds and returned to base with history's first eclipse data recorded from a jet observatory. This airborne success prompted a rather ambitious proposal involving nine eclipse experiments, approved by LASL Director Norris Bradbury in 1964. The AEC sanctioned the use of its aircraft—modified Air Force type Boeing 707's—for the 1965 eclipse and SEX II was off and running. The aircraft had been modified for AEC use, primarily as flying diagnostic laboratories in the test readiness program. However, it was AEC policy that the aircraft would be available for other appropriate scientific tasks, finances permitting, on a noninterference basis with the readiness program.

Art Cox, J-15 group leader and professional astronomer who had helped Liebenberg, Williamson and Stone formulate the original proposal to the director's office, led the pioneer group of 17 LASL experimenters to base at Pago Pago, American Samoa. Air Force pilot for the mission was Major Jim Wells who later retired and joined LASL in J-1 where he is now associate group leader and frequently assists with planning eclipse expedition logistics. A sister AEC flying laboratory joined the expedition with a scientific crew from Sandia. Sandia and LASL also cooperated in launching rockets from Rarotonga into the eclipse path to study solar x rays during totality and after.

LASL's SEX II expedition set up an area and a format of investigation which has continued through SEX III (Nov. 12, 1966), SEX IV (March 7, 1970), and most recently SEX V, the July 10, 1972 eclipse which was intercepted by the flying astronomers and chased for 225 seconds at 39,100 feet altitude northwest of Hudson Bay.

As it had been in all previous expeditions, the solar corona, the glowing convulsive envelope of hot gas that surrounds the sun, was the prime area of investigation. Several experiments looked at geophysical phenomena, but the three major experimental systems probed the corona in a variety of ways. And like the expedition in 1965, the airborne crew had LASL colleagues on the ground at Poker Flat, Alaska, firing a rocket payload into totality. In this case it was in an attempt by Brook Sandford, Henry Horak, Karl Theobald, all J-10, and Ted Krein, Sandia, to measure brightness and polarization of zodiacal light during eclipse at many different positions relative to the sun.

Zodiacal light, a wedge-shaped diffuse glow usually seen in the west at twilight and in the east before dawn, is believed to be caused by the reflection of sunlight from myriads of small particles in interplanetary space.

Aboard the aircraft the Rube Goldberg system once again had the distinction of being the largest and most sophisticated series of experiments in the air. The large, 10-inch-diameter, 80-inch-focallength telescope delivered the coronal light to interferometers just as in 1965. However, in 1970 Marv Hoffman, J-12, suggested and supervised installation of a high-resolution television system to record data on video tape. This allows the entire eclipse to be replayed, studied and analyzed in the convenience of the laboratory. This year the system was further improved by adding a combination image intensifier and vidicon tube for increased sensitivity.

The Rube has now accumulated data from four eclipses covering the 11 year solar cycle from minimum activity (1965) to near maximum (1970) and on the down side again in 1972. Comparison of the temperatures recorded over a number of regions seems to indicate that coronal temperature is independent of the solar cycle and more dependent on local activity. Information on macroscopic turbulence which is related to coronal heating mechanisms is being studied to give clues to the origin of solar wind. Intensity changes in specific areas of the corona out to 2.9 solar radii, a record for seeing emission line profiles, have been noted and are under investigation to help understand processes in the corona.

This year Jacques Beckers, Sacramento Peak Observatory, joined forces with the LASL Rube crew of Liebenberg, Hoffman, Joe Calligan and Mort Sanders, J-12, and Charles Milich, N-4, to record data on polarization of the emission line of highly-ionized iron at a wavelength of 5,303 Angstroms. This data contains the most direct information available on direction and magnitude of solar magnetic fields. It will be compared with theoretical models of the magnetic field structure developed by the High Altitude Observatory at Boulder, Colo.

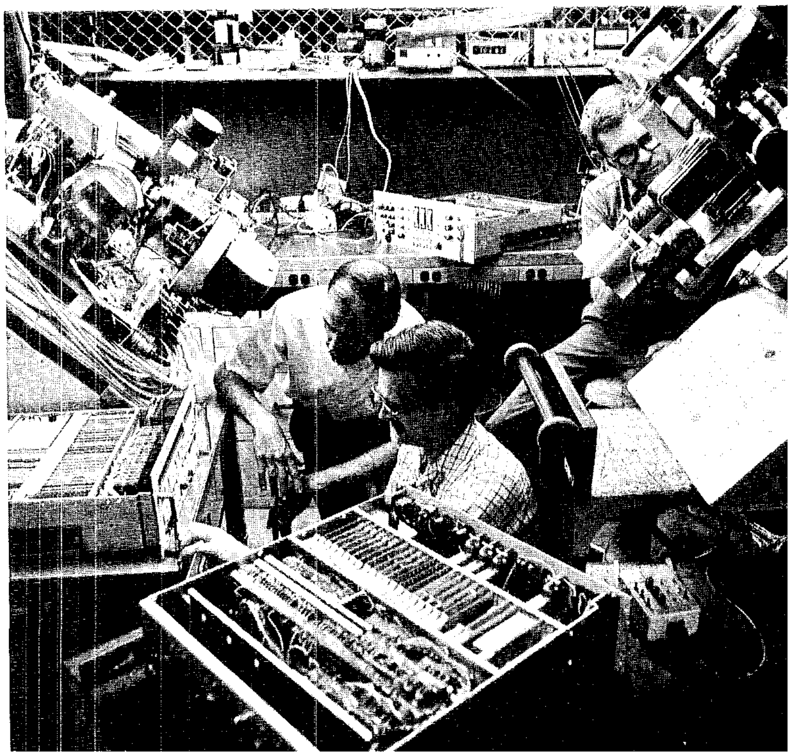
One of the hard to estimate, but nonetheless real, benefits to the laboratory of non-programmatic work like eclipse missions is the wide support effort which cuts completely across normal divisional lines. This tends to stimulate interdivisional communication between staff members who do not normally have such contact. The reputation of LASL for the ability to do almost anything is certainly enhanced by this sort of interchange and exercise.

Since the beginning of eclipse missions, the success of the effort has been due to the strong support of many groups throughout the laboratory. Although J-Division has participated almost division-wide, it is not exclusively a test division exercise. Great dependence has been placed on such diverse groups as N-4, M-3, M-5, and M-2, E-5, P-4 and P-8, ISD-1 and ISD-7, and SD-1 and SD-2.

Coupled with all this has been a strong development program to put together systems and refine techniques peculiarly suited to aerial observations. Cox, the four-time expedition coordinator, in the very beginning developed with Don Eilers, J-15 mathematician, a computer code for predicting details of total solar eclipse circumstances for aircraft interceptions. This has been widely used by all other aerial observers.

Ralph Partridge, J-DO, has designed and continually improved photo tracking systems which permit experiments to lock on the eclipsed sun and hold it centered with a minimum error now down to less than six arc seconds. This is roughly the equivalent of pointing a rifle at a penny-size target a mile away and holding steady without losing aim for five minutes. Special high quality lens systems have been produced by Berlyn Brixner, M-5, using a lens design computer code. And in the area of stabilized platforms and servo systems, major contributions have come from Joe Perry, formerly N-4, Ed Brown, N-4, and Bobby Strait, E-5. All of these developments are dependent on each other for the successful aerial observations for which LASL is now world known.

Electronics engineers Bobby Strait, center, and Darrell Call, right, both of E-5, worked night and day to prepare two sophisticated stabilized platforms for the coronal camera experiment of Charles Keller, left, J-15, and a radially symmetric, neutral-density-filter experiment by Bill Regan, ISD-1. Strait has been a leader in developing three-axis, gyro-controlled systems which have established new marks in accuracy.



the technical side

Taken from LASL Technical Information Reports submitted through ISD-6

Division of Research, National Nuclear Data Committee, Los Alamos Scientific Laboratory, May 22-26:

"Program of Measurement of Delayed-Neutron Yields, Decay Groups and Group Abundances, and Delayed Neutron Spectra" by A. E. Evans, A-1 (invited)

Technical Committee of Federal Council on Science and Technology, Washington, D.C., May 24-25:

"Post-1980 Reactor Test Program" by F. L. Ribe, P-DO, A. P. Fraas, Oak Ridge National Laboratory, Tennessee, and F. Tenney, Princeton Plasma Physics Laboratory, N.J.

"The Ultimate Potential of Fusion Reactors" by S. C. Burnett, P-15

Fourth International Cryogenic Engineering Conference, Eindhoven, The Netherlands, May 24-26:

"Multiple Use of Cryogenic Fluid Transmission Lines" by J. R. Bartlit and F. J. Edeskuty, both P-8

Second International Symposium on Power from Radioisotopes, Madrid, Spain, May 29-June 2:

"Characterization and Properties of Medical-Grade ^{238}Pu Fuels" by L. J. Mullins, CMB-11, G. M. Matlack and J. Bubernak, both CMB-1, and J. A. Leary, CMB-DO

Seminar, University of Colorado Medical School, Denver, May 30:

"DNA Constancy in Heteroploidy" by P. M. Kraemer, H-4 (invited)

Thirteenth Annual Meeting of the Institute of Nuclear Materials Management, Boston, Mass., May 31-June 2:

"^{225}Ca Fuel Rod Assay System: In-Plant Performance" by R. A. Forster, D. B. Smith and H. O. Menlove, all A-1

"Assay Experience with MONAL at Oak Ridge" by T. D. Reilly, A-1

Atomic Energy Commission Information Meeting, Los Alamos, June 1-2:

"Use of Large Computer Programs in Time-Sharing and Interacting Mode" by H. F. Vogel, MP-7, and J. Colonias, Lawrence Berkeley Laboratory, Calif.

Technion—Israel Institute of Technology, Haifa, June 5:

"The Phase Transitions and Crystal Structures of Nitrogen and Deuterium" by A. F. Schuck and R. L. Mills, both P-8, and J. L. Yarnell, P-2 (invited)

American Physical Society, Albuquerque, June 5-7:

"Pulsed Quench Method for Beam Polarization Measurement" by P. A. Lovoi, University of New Mexico, Albuquerque, G. G. Ohlsen, P-DOR, and R. D. Hiebert, E-4

"The States of ^{19}F Populated by the ^{20}NE(t,a) Reaction" by J. D. Garrett and O. Hansen, both P-DOR, and R. Middleton, University of Pennsylvania, Philadelphia

"Elastic Scattering of Polarized Deuterons from ^{52}Cr, ^{56}Fe, ^{60}Ni, ^{90}Zr, ^{122} Sn, and ^{197}Au" by D. D. Armstrong, P-12, R. A. Hardekopf and P. W. Keaton, both P-DOR

"A Folding Model for the Deuteron Optical Potential" by P. W. Keaton, P-DOR, and D. D. Armstrong, P-12

"Proton Polarimeter Design for Polarization Transfer Experiments" by R. A. Hardekopf and P. W. Keaton, both P-DOR, and D. D. Armstrong, P-12

" 'Supercube' Scattering Chamber for Polarized Beams" by G. G. Ohlsen, G. C. Salzman and P. W. Keaton, all P-DOR, and J. L. McKibben, P-9

"He^4(d, d)He^4 Analyzing Power Measurements" by G. C. Salzman, C. K. Mitchell, and G. G. Ohlsen, all P-DOR

"He^4(d, d)He^4 Tensor Polarization Transfer" by C. K. Mitchell, G. G. Ohlsen and G. C. Salzman, all P-DOR

"Measurement and Theory for the Inverse Pinch Phase of Plasma Focus Discharge" by R. A. Gerwin, A. H. Williams, K. D. Ware, J. W. Mather, all P-7, and J. P. Carpenter, formerly P-7

"Electron Beam/Plasma Focus Interaction" by J. W. Mather, K. D. Ware, A. H. Williams, all P-7, and J. P. Carpenter, formerly P-7

"Characteristics of Current in a Plasma Focus Accelerator" by K. D. Ware, A. H. Williams, J. W. Mather, all P-7, and J. P. Carpenter, formerly P-7

"Practical Applications at LAMPF" by L. Rosen, MP-DO, and E. A. Knapp, MP-3 (invited)

"Feedback Stabilization on a Theta-Pinch Plasma Column" by R. F. Gribble, S. C. Burnett, and C. R. Harder, all P-15

"Plasma Pressure Profiles of ZT-1A" by P. R. Forman, L. C. Burkhardt, J. N. Di Marco, H. J. Karr and J. A. Phillips, all P-14

"Preionization and its Effects on Pinch Formation in ZT-1A" by J. N. Di Marco, L. C. Burkhardt, H. J. Karr, P. R. Forman, and J. A. Phillips, all P-14

"Plasma Experiments on $\iota = 1$, 0 Helical Equilibria in the Scyllac Five-Meter, Theta-Pinch Toroidal Sector" by W. E. Quinn and G. A. Sawyer, both P-15, and C. F. Hammer, P-16

"Measurements of Plasma Parameters in the Scyllac Five-Meter Toroidal Sector" by W. R. Ellis, F. C. Jahoda and R. E. Siemon, all P-15

"Plasma Experiments in the Scyllac Five-Meter, Linear Theta Pinch" by K. S. Thomas, F. C. Jahoda and G. A. Sawyer, all P-15, and H. W. Harris, P-16

"Energy Dependence of the S_{11} Inelasticity Parameter of π—N Scattering: What is the Nature of the S_{11} (1535) Resonance?" by R. R. Silbar, T-5, and W. H. Klink, visiting staff member in T-5

"A Continuous Two Dimensional Eulerian Technique for Multicomponent Reactive Compressible Flow Calculations" by J. D. Kershner and C. L. Mader, both T-4

"Numerical Solution of a Non-Linear Diffusion Problem" by A. Haberstich, P-14

"Levels of ^{151}Nd from the ^{150}Nd (n,γ) Reaction" by H. A. Smith Jr., J. W. Starner and M. E. Bunker, all P-2

"Angular Distributions of the Analyzing Power in the Triton(proton, neutron) Helium-3 Reaction at 6.00, 9.95 and 13.55 MeV and Comparison to Polarization Data" by J. J. Jarmer, R. C. Haight, J. C. Martin, J. E. Simmons, all P-DOR, and T. R. Donoghue, visiting staff member in P-DOR

"Measurement of the Lamb-Shift in ^{16}O" by G. P. Lawrence, W-11, and C. Y. Fan and S. Bashkin, both University of Arizona, Tucson

"Neutron-Proton Exchange Current Due to a Charged Pseudoscalar Meson" by R. H. Thompson and L. Heller, both T-5

"The Numerical Simulation of Air Pollution in the Vicinity of Buildings" by R. S. Hotchkiss, T-3 (invited)

"A Study of Visible and Near-UV Radiation from Long-Lived States of N_2^+ (Nitrogen Molecular Ion)" by W. B. Maier, II, and R. F. Holland, both J-10

"Extended Huckel Theory β Formulas Applied to Diatomic Molecules" by Sandra Z. Engelke, CMB-5

"NMR Measurement of Self-Diffusion in Viscous Media" by L. J. Burnett, CNC-2, and J. F. Harmon, formerly MP-7

"Clean Energy From the Earth" by M. C. Smith, CMB-13 (invited)

Twenty-third Annual Meeting of the Tissue Culture Association, Symposium on Cell Nutrition in Culture, Los Angeles, Calif., June 5-8:

"Effects of Sub-Optimal Quantities of Isoleucine Upon Macromolecular Synthesis in Chinese Hamster Cells" by R. A. Tobey, H-4 (invited)

Third International Conference on Thermionic Electrical Power Generation, Julich, Germany, June 5-9:

"Effect of Fast Neutron Irradiation on Alumina and Yttria" by W. A. Ranken and T. G. Frank, both N-5, and G. W. Keilholtz, Oak Ridge National Laboratory, Tenn.

"Effect of Neutron Spectra on the Swelling of Ceramic Insulators and Implications for Thermionic Reactor Design" by T. G. Frank, N-5, and C. E. Backus, visiting staff member in N-5

"Behavior of Tungsten-Clad $MoUO_2$ Fuel Under Neutron Irradiation at High Temperature" by W. A. Ranken, N-5, and W. H. Reichelt, L-1

Naval Research Laboratory Conference on Sub-LF Downlink Satellite Communications, Washington, D.C., June 6-9:

"Parametric Instabilities of LVF Waves" by D. W. Forslund, P-18, J. M. Kindel, T-6, and E. L. Lindman, J-10

Astronomical League, Albuquerque, June 10:

"Solar Physics in the Shadow of the Moon" by D. H. Liebenberg, P-8 (invited)

Twenty-Seventh Annual Symposium on Molecular Structure and Spectroscopy, Columbus, Ohio, June 12-16:

"The Far-Infrared Electronic Spectrum of Nitric Oxide" by R. S. McDowell, CNC-4, W. R. Simmons, G. W. F. Pardoe, R. A. Bohlander, and H. A Gebbie, all University of Colorado, Boulder

Annual Meeting, Health Physics Society, Las Vegas, Nev., June 12-16:

"Estimation of Chest Wall Thickness in Lung Counting for Plutonium" by P. N. Dean, H-4

"Intercalibration for Low-Energy Photon Measurements" by K. L. Swinth, Battelle Memorial Institute, Richland, Wash., and P. N. Dean, H-4

"Factors Affecting the Design of Albedo-Neutron Dosimeters Containing Lithium Fluoride Thermoluminescent Dosimeters" by D. E. Hankins, H-1

"Relationship Between Air Sampling Data from Glove Box Work Areas and Inhalation Risk to the Worker" by M. Gonzales, H. J. Ettinger, R. G. Stafford, all H-5, and C. E. Breckinridge, University of Arkansas, Fayetteville

Third Annual Computer Simulation Conference, San Diego, Calif., June 14-16:

"Particulate Transport in Highly Distorted Three-Dimensional Flow Fields" by R. S. Hotchkiss, T-3, and C. W. Hirt, formerly T-3

Lutheran Hospital and Homes Society Meeting, Steamboat Springs, Colo., June 15:

"The Los Alamos Meson Physics Facility (LAMPF)--A New Tool for Basic Research and Practical Applications" by L. Rosen, MP-DO (invited)

Workshop on Feasibility and Need for a High Intensity Pulsed and Steady State Fast Neutron Source, AEC Operations Office, Las Vegas, Nev., June 17:

"WNR—A Neutron Time-of-Flight Facility at the Los Alamos Scientific Laboratory" by M. S. Moore, W-11

"LASL Intense 14-MeV Neutron Source" by D. B. Henderson, L-DOT

1972 Annual Meeting, American Nuclear Society, Las Vegas, Nev., June 18-22:

"Preparation of Data Libraries for Efficient Retrieval by Continuous Energy Monte Carlo Codes" by C. R. Weisbin, D. R. Harris, M. E. Battat, R. J. LaBauve, R. E. Seamon, all T-2, W. M. Taylor and G. D. Turner, both TD-6

"Problems and Techniques in Computation of Multigroup Cross Sections" by R. J. LaBauve, C. R. Weisbin, R. E. Seamon, and D. R. Harris, all T-2

"Multitable-Multigroup Photon-Production Cross-Section Computation" by D. J. Dudziak, T-1 (invited)

"A Meson Factory as a Neutron Irradiation Facility" by D. J. Dudziak, T-1, W. V. Green and E. G. Zukas, both CMB-13, and T. R. Regenie, ENG-6

continued on next page

"Accelerators in Research" by E. A. Knapp, MP-3 (invited)

"A Two-Dimensional Multigroup Transport Benchmark Problem" by K. D. Lathrop, T-1

"Effectiveness of Convergence Acceleration Options in Transport Calculations" by K. D. Lathrop, T-1

"Laser Superradiance" by K. D. Lathrop, T-1

"Elimination of Ray Effects in Curved Geometries" by K. D. Lathrop, T-1

"Calculations of Reflected Fast Critical Assemblies and Comparison with Experiment" by M. E. Battat, T-2, and T. J. Hirons, TD-4

"A General Method for Solving the P_L Equations" by W. H. Reed, T-1

"Gas-Dynamic Fuel Cycling in a Pulsed Fusion Reactor" by T. A. Oliphant, P-18, and F. L. Ribe, P-DO

"Parameter Study of a Pulsed High-Beta Fusion Reactor" by S. C. Burnett and W. R. Ellis, both P-15, and F. L. Ribe, P-DO

"Spectrum of Neutrons Produced by 800-MeV Protons on Uranium" by L. R. Veeser, R. R. Fullwood and E. R. Shunk, all P-3, and A. A. Robba, A-2

"Continuing Need for Criticality Data" by H. C. Paxton, N-2 (invited)

"^{252}Cf Ruel Rod Assay System: In-Plant Performance" by D. B. Smith, R. A. Forster, H. O. Menlove, all A-1, and H. M. Forehand, University of Arizona, Tucson

"Revised LASL Delayed-Neutron Yield Data" by A. E. Evans and M. M. Thorpe, both A-1

"Future Developments in Aerospace Nuclear Programs" by J. D. Balcomb, N-DO

"Neutronic Characteristics of a Pulsed-Fusion Reactor Using Laser-Initiated (D+T) Pellets" by C. W. Matson, N-DOT

"Recent U.S. Progress in Meeting the Needs for Nuclear Data" by M. S. Moore, W-11

"The Induction and Growth of Fractures in Hot Rock: Artificial Geothermal Reservoirs" by R. L. Aamodt, J-DO, and M. C. Smith, CMB-13

"Thermal Expansion of PuO_2 from 25 to 1,420°C" by M. Tokar, CMB-11, and A. W. Nutt, W-7

"Multi - Hundred - Watt Heat Source Technology. Part I. Fabrication Development and Compatibility Testing" by R. N. R. Mulford and D. Pavone, both CMB-5, and T. K. Keenan, M. W. Shupe, and M. Tokar, all CMB-11, and A. W. Nutt, W-7

"Big Ten, A 10% Enriched Uranium Critical Assembly: Kinetic Studies" by J. L. Sapir, H. H. Helmick, and J. D. Orndoff, all N-2

"The Use of Accelerators in Nuclear Safeguards" by C. J. Umbarger, A-1 (invited)

Physics Seminar, Michigan State University, East Lansing, June 19:

"Special Topics in Nuclear Pairing" by E. R. Flynn, P-12 (invited)

Gordon Research Conference on Plasma Physics, Tilton, N. H., June 19-23:

"Classical-Heating Effects in Anomalous AC Resistivity Measurements" by J. C. Ingraham, P-13

"Theory of the Microstructure of the Earth's Bow Shock" by D. W. Forslund, P-18 (invited)

"Electron and Ion Thermal Energy Transport in the Solar Wind" by W. C. Feldman, P-4 (invited)

Seminar, Lockheed Palo Alto Research Laboratory, Calif., June 20:

"A Los Alamos Compilation of Air Opacities" by A. N. Cox and J. E. Tabor, both J-15

Workshop on Parallel Computation, Seattle, Wash., June 20-22:

"A Fast Poisson Solver Amenable to Parallel Computation" by B. L. Buzbee, C-4

CTR Standing Committee Meeting, Los Alamos, June 21-22:

"Theta-Pinch Research — Future Plans" by F. L. Ribe, P-DO

"Projected LASL Experiments to Study Shock Heating, Wall Stabilization, Theta-Pinch Staging and Plasma Sheath Scaling" by F. L. Ribe, P-DO, and J. Marshall, P-17

International Conference on Padé Approximants, Continued Fractions and Related Topics, Boulder, Colo., June 21-24:

"Rational Approximants for Inverse Functions of Two Variables" by C. L. Critchfield and J. L. Gammel, both T-9

"Continuation of Functions Beyond Natural Boundaries" by J. L. Gammel, T-9

Raytheon Company, Sudbury, Mass., June 22:

"High-Energy Short-Pulse CO_2 Amplifier Systems Based Upon Electron Beam Controlled Discharge Pumping" by C. A. Fenstermacher, L-1

International Conference on Padé Approximants and their Applications, University of Kent, Canterbury, England, June 26-July 28:

"The Padé Approximant and Generalizations" by J. L. Gammel, T-9

"The Effect of Random Errors in the Coefficients of Power Series on Padé Approximants" by J. L. Gammel, T-9

"Nonlinear Padé Approximants for Legendre Series" by J. B. Fleisher, T-9

"Generalizations of Padé Approximants" by J. B. Fleischer, T-9

American Institute of Aeronautics and Astronautics Fifth Fluid and Plasma Dynamics Conference, Boston, Mass., June 26-28:

"Motion of Solid D_2 Under Laser Irradiation" by R. S. Cooper, TD-1

Gordon Research Conference on Nuclear Chemistry, New London, N.H., June 26-30:

"Fission Barrier Parameters from Analysis of Shape Isomer and Direct-Reaction Fission Correlation Results" by H. C. Britt, P-DOR (invited)

Computer Output Microfilm Technology Third Semiannual Conference, Denver, Colo. June 28-30:

"An Investigation of Computer

Generated Optical Sound Tracks" by E. K. Tucker, ENG-7, L. H. Baker, W-2, and D. C. Buckner, E-1

"Computer Film Output—in Living Color" by D. O. Dickman, C-4

Seminar, Department of Physics, St. Louis University, Mo., June 30:

"Current Algebra, Broken Symmetry and Special Sum Rules" by B. R. Wienke, T-5

Rocky Mountain Regional Meeting, American Chemical Society, Colorado State University, Fort Collins, June 30-July 1:

"Structural Alterations of Histones in Cultured Mammalian Cells" by G. R. Shepherd, H-4

"Simple Polyisotopic Molecules" by T. W. Whaley and D. G. Ott, H-4

"**In Vitro** Studies on the Synthesis of Ribonucleic Acid Using X-Irradiated RNA Polymerase" by G. F. Strniste and D. A. Smith, both H-4

"Synthesis with Stable Isotopes" by D. G. Ott, V. N. Kerr, and T. W. Whaley, all H-4

"Effects of X-Irradiation on DNA Precursor Metabolism and DNA Replication in Chinese Hamster Cells" by R. A. Walters, L. R. Gurley, R. A. Tobey, M. D. Enger, and R. L. Ratliff, all H-4

"The Kinetics of the Reaction between the Chromium (III)-Plutonium (V) Complex and Plutonium (III) in Aqueous Perchlorate Solutions" by Carolyn B. Lavallee, formerly CNC-2, and T. W. Newton, CNC-2

"^{13}C Chemical Shifts and Rh-^{13}C Coupling Constants of Some ^{13}C Enriched Rhodium Carbonyl Complexes" by P. J. Vergamini and N. A. Matwiyoff, both CNC-4

Second Topical Conference on Pulsed High-Beta Plasmas, Max Planck Institute for Plasma Physics, Garching, West Germany, July 3-6:

"MRD Stability Studies of Numerically Obtained Toroidal Equilibria" by D. A. Baker and L. W. Mann, both P-18

"Stability of Two-Dimensional Magnetohydrodynamic Equilibria" by J. P. Friedberg and B. M. Marder, both P-18

"MHD Stability of Diffuse Two-Dimensional Equilibria" by J. P. Freidberg and B. M. Marder, both P-18

"A Vlasov-Fluid Model for Studying Gross Stability of High Beta Plasmas" by J. P. Freidberg and H. R. Lewis, both P-18

"Stability of a Finite Beta, L Equals Two Stellerator" by J. P. Freidberg, P-18

"Modeling of Long Straight Theta-Pinches" by R. L. Morse and W. P. Gula, both T-6

"Feedback Stabilization on an $\iota = 1$ Theta-Pinch Column" by R. F. Gribble, S. C. Burnett, and C. R. Harder, all P-15

"Pulsed High-Beta Fusion Reactor Based on the Theta Pinch" by S. C. Burnett and W. R. Ellis, both P-15, T. A. Oliphant, P-18, and F. L. Ribe, P-DO

"Plasma Experiments on $\iota = 1, 0$ Helical Equilibria in the Scyllac 5-Meter, Theta Pinch Toroidal Sector" by W. R. Ellis, F. C. Jahoda, W. E. Quinn, and R. E. Siemon, all P-15, C. F. Hammer, P-16, and F. L. Ribe, P-DO

"Plasma Experiments in the Scyllac Five-Meter, Linear Theta Pinch" by K. H. Thomas, F. C. Jahoda, G. A. Sawyer, and R. E. Siemon, all P-15, and H. W. Harris, P-16

"Two-Stage Heating of Theta-Pinches" by J. P. Freidberg, P-18, and R. L. Morse, T-6

"Recent Results from the Shock-Heated Toroidal Z-Pinch Experiment ZT-1" by L. C. Burkhardt, J. N. Di Marco, P. R. Forman, A. Haberstich, H. J. Karr and J. A. Phillips, all P-14

Third International Conference on Numerical Methods in Fluid Dynamics, University of Paris, France, July 3-7:

"Turbulence Transitions in Convective Flow" by B. J. Daly, T-3

"Transient Three-Dimensional Fluid Flow in the Vicinity of Large Structures" by B. D. Nichols, T-3, and C. W. Hirt, formerly T-3

M. D. Anderson Hospital and Tumor Institute, Texas Medical Center, Houston, July 6:

"Physical and Radiobiological Aspects of π^- Mesons with Reference to Radiotherapy" by M. R. Raju, H-4 (invited)

European Group for Atomic Spectroscopy, Amsterdam, Netherlands, July 10:

"The Classification of Transitions between Levels of Principal Quantum Numbers 3 and 4 in Fe IX to XVI, Mn VIII to XV, Cr VII to XIV and V VI to XIII" by B. C. Fawcett and R. W. Hayes, both Culham Laboratory, Berkshire, England, E. Y. Kononov, The Spectroscopic Institute, Moscow, USSR, and R. D. Cowan, T-4

Regional Conference on the Numerical Solution of Nonlinear Algebraic Systems with Applications to Problems in Physics, Engineering, and Economics, University of Pittsburgh, Pa., July 10-14:

"Experiences with Optimization in the Los Alamos Environment" by M. M. Klein and T. C. Doyle, both C-6

Seminar, Department of Physics, University of Washington, Seattle, July 17:

"Measurement of the Lamb-Shift in ^{16}O" by G. P. Lawrence, W-11, C. Y. Fan and S. Bashkin, both University of Arizona, Tucson

Sixth International Cyclotron Conference, TRIUMF, University of British Columbia, Vancouver, Canada, July 18-21:

"A New Beam Spill Control for LAMPF" by J. R. Parker, J. H. Richardson, and J. D. Easley, all MP-1

Twenty-seventh Annual Calorimetry Conference, Park City, Utah, July 19-22:

"The Enthalpy of Formation of Barium Oxide" by C. E. Holley, Jr., G. C. Fitzgibbon, and E. J. Huber, Jr., all CNC-2

20 years ago in los alamos

Culled from the September, 1952, files of The Santa Fe New Mexican
by Bob Brashear

The Problem in Getting Housing

Eighteen three-bedroom housing units scheduled for assignment on a Monday were in such demand that a line of people started forming in front of the AEC Housing Office on Friday. The early comers came equipped with food, sleeping bags and other paraphernalia necessary for the three-night wait. But, AEC officials took pity on them. Names were taken in order of arrival and the people were promised admittance in that order Monday morning.

Unearthly Spies?

Air Force officials said an unidentified flying object was sighted hovering over the Los Alamos Scientific Laboratory. The object—saucer maybe?—was reported to have darted over and around the atomic installation for more than 30 minutes.

Self-Supporting City

Another step in the AEC plan to bring Los Alamos to a self-supporting basis appeared with the announcement that Hill civic groups would be charged a fee for using available meeting halls.

The First One was Rained Out

The first annual all-star game of the Hill Little League was rained out and was rescheduled a week later at the baseball field on North Mesa. Canyon and Mountain School teams combined to oppose a Mesa-Aspen coalition.

Society Notes

Social activities included the Fifth Annual President's Cup Handicap Golf Tournament under the direction of the Civic Club; the Sixth Annual Flower and Garden Show, sponsored by the Los Alamos Garden Club; and the 39th annual exhibition for New Mexico Artists at the Museum of New Mexico Art Gallery. There were seven entries from Los Alamos.

what's doing

BIEN DICHO TOASTMASTERS CLUB: Luncheon meeting, 12:05 p.m., Mondays, South Mesa Cafeteria. For information call William Pracht, 672-1920.

SIERRA CLUB: Luncheon meeting at noon, first Tuesday of each month, South Mesa Cafeteria. For information call Brant Calkin, 455-2468, Santa Fe.

RIO GRANDE RIVER RUNNERS: Meetings scheduled for noon, second Friday of each month at South Mesa Cafeteria. For information call Joan Chellis, 662-3836.

LOS ALAMOS SAILORS: Meetings at noon, South Mesa Cafeteria, first Friday of each month. For information call Dick Young, 662-3751.

SPORTS CAR CLUB DEL VALLE RIO GRANDE: Meetings, 7:30 p.m., Hospitality Room, Los Alamos National Bank, first Tuesday of each month. For information call Gerry Strickfadden, 672-3664 or Frank Clinard, 662-4951.

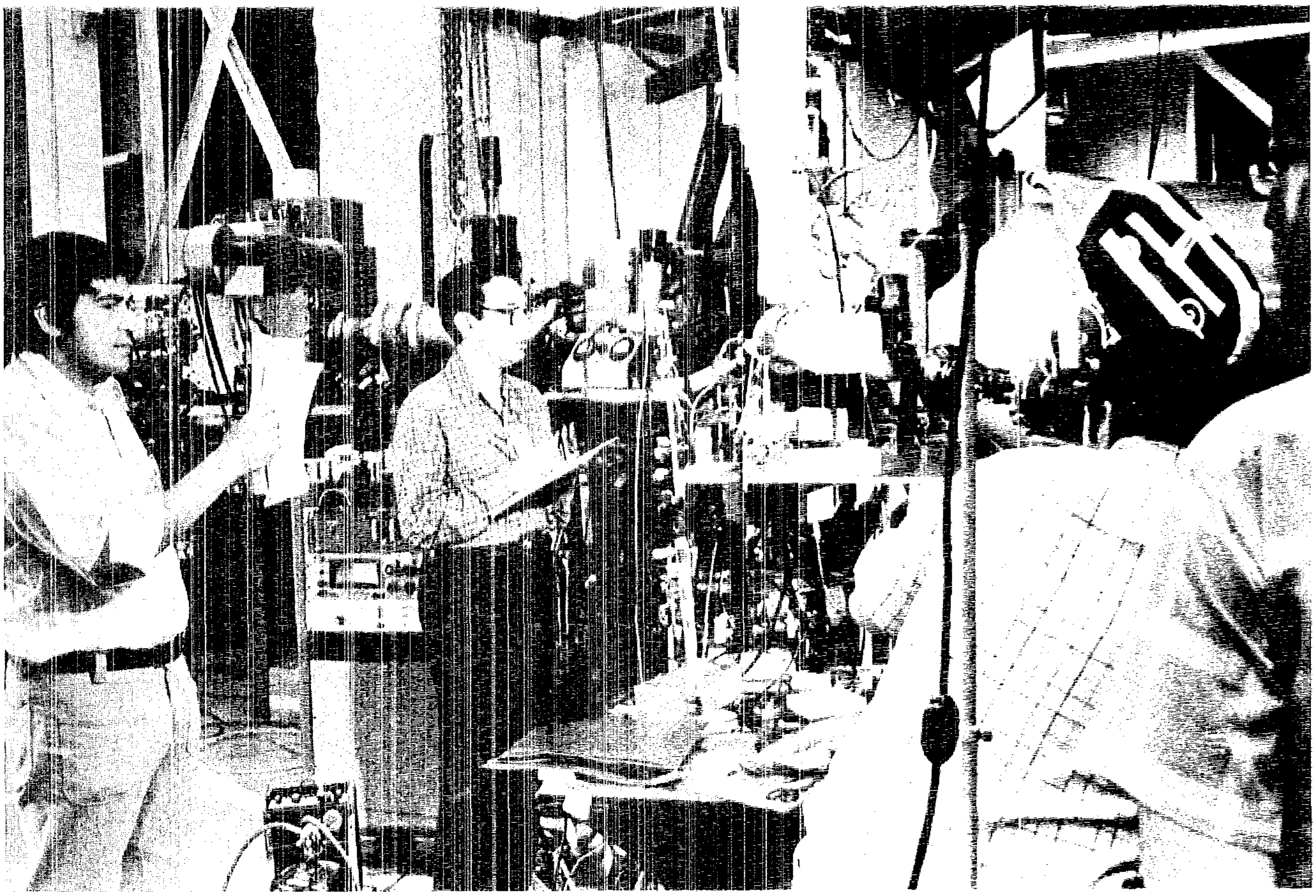
NEWCOMERS CLUB: Sept. 27, 1 p.m., Fashion Show and Luncheon, Los Alamos Golf Club. For information call Linda Hertrich, 662-9355.

OUTDOOR ASSOCIATION: No charge, open to the public. Contact leaders for information.
- Sept. 9-10: San Pedro Wilderness, Dana Douglass, 662-3088
- Sept. 14: Noon meeting, South Mesa Cafeteria, Reed Elliott, 662-4515
- Sept. 20: Picnic, Las Conchas, 6 p.m., Reed Elliott, 662-7410
- Sept. 30-Oct. 1: Pecos Wilderness, Ken Ewing, 662-7488

MOUNTAIN MIXERS SQUARE DANCING CLUB: Mesa School, 8 p.m. For information call Ruth Maier, 662-3834.
- Sept. 2: Ray Rogers, Albuquerque
- Sept. 16: Bones Craig, club caller

MESA PUBLIC LIBRARY:
- July 24-Sept. 13: Secundino Sandoval, acrylics
- Aug. 23-Sept. 12: Library display, figures from books
- Sept. 11-Oct. 2: Church Women United, Christmas store display
- Sept. 13-Oct. 9: Los Alamos Council on Alcoholism display

PUBLIC SWIMMING: High School Pool—Monday through Wednesday, 7:30 to 9:30 p.m.; Saturday and Sunday, 1 to 5 p.m., Adult swim club, Sunday, 7 to 9 p.m.



A film crew from Screen Digest News was in Los Alamos to photograph LASL scientist Fred Young for inclusion in a film documentary on the Navajo Indians. Young, a Navajo and a physicist in Group L-4, was photographed doing an experiment at the Tandem Van de Graaff accelerator. At left Mario Balibrera, ISD-7, assists cameraman Manny Alpert by reflecting light from a notebook. At right is film producer Cloyd Aarseth. Screen Digest News films documentaries for use in high school classrooms.

Henry T. Motz
3137 Woodland
Los Alamos, New Mexico 87544

Laboratory Director Harold Agnew congratulates CMB-Division Leader Richard Baker for the division's safety performance. Over the past two years, members of CMB-Division worked 1.8 million man hours without a disabling accident. The award was last presented to CMB-Division in 1949 for 921,000 man hours. Other safety awards were presented to CMB-Division groups. These included CMB-13, represented by Bob Gibney, group leader, second from left, whose members worked 1.4 million man hours in 15 years without a disabling accident; CMB-14, John Schulte, group leader, 475,000 man hours in 16 years; CMB-1, William Ashley, assistant group leader, second from right, 1.4 million man hours in 13 years; and CMB-6, James Taub, group leader, 1.5 million man hours in five years.